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MODEL AIRPLANE NEWS

THE WORLD'S PREMIER R/C MODELING MAGAZINE Canada $2.75

Build a B-25 Bomber

Basic Control Systems

Great Modeling Tips!

Getting Started in SOARING

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MODEL AIRPLANE NEWS

ON THE COVER: The B-25 Mitchell seems at home flying at treetop level, a feat perfected by WW II pilots. Read about this fascinating plane in Budd Davisson's story on page 64. This B-25N owned and flown by Edwin Schnepf, publisher of Challenge Publications.
ABOVE: There is something special about floatplanes, and Dick Hershey's Douglas World Cruiser, which took three years to construct, is really special. Dick was at the 1986 Clearlake Float-Fly which is covered in this issue starting on page 20.

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

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Editorial

by DAN SANTICH

INTEGRITY, PRIDE, QUALITY—these are all aspects that point to greatness. This magazine has had all of these and more since its very first day of publication. Integrity in the scope of coverage, pride in the result, and quality in the contents and in the patronage of the reader. Quality in patronage means that you, the modeler, require top-notch designs and information to keep your enthusiasm fulfilled. We have done that for a long time. The hobby changes. New techniques, products, and directions are an indication of growth and as the hobby grows, so does the modeler.

The balance between desires, supply of products, and information about the two is where we come in. If there's a shift in interest that is substantial enough to warrant products to support it, we help out by providing both sides of the picture so that a greater understanding can be had by manufacturers and consumers alike. But who is the guiding force? And when does critical observation and reporting apply? For myself I can honestly say that some manufacturers only want favorable things written about their products. But what if I find a serious problem? How much pressure can someone put on me to print a favorable review when the contrary is really appropriate? The pressure in such cases is the loss of revenue from advertising. And believe me, it happens.

I am a modeler who happens to work for a modeling magazine. I identify with and appreciate the problems we all face. It is therefore my belief that I am on the side of the consumer. For a company to apply pressure through loss of advertising and by preventing a columnist from participating in their special activities is not only blackmail, it is destructive to the concept by which modeling has thrived—a sharing of creative efforts.

I will not yield to this perchloric effort except to the extent of telling you that not all things are as they appear. A company that reverts to such tactics has hidden skeletons that they try to keep invisible at all costs. Unfortunately for these parties, the truth prevails in the long run. Modelers know this.

THIS MONTH. Sig Manufacturing is one of the strongest, best organized, and well-equipped model companies in this country and their new offering shows it. To take an obscure airplane like the Morrisey Bravo and make a kit out of it is a big gamble in anyone's book. But to make it a giant-scale model is something else and that is just what the new Sig kit is; something else. I saw this airplane perform in Las Vegas and it's one fine flying airplane. Burnis Fields can tell you more because he actually built one and his review is in this issue.

Chris Chianelli saw a WW II picture on television and got the bug to build a B-25. He selected the Royal kit and now he's ready to join the Confederate Air Force. His review is also in this issue.

That's it for this month. Just remember that every phase of modeling brings with it a unique possibility for improvement of our own efforts.

DBS.

Airwaves

More "Pro & Con"

The feature, "From the Cockpit" by Budd Davisson sets *M.A.N.* apart from run-of-the-mill modeling magazines. Many of us are model airplane builders and fliers because of our fascination with full-size aircraft and Davisson provides us, vicariously, with the pleasure of flying them.

Not all of us like the same types of articles and I have an idea that could be used by the readers who think that full-size aircraft shouldn't be featured in *Model Airplane News*. They can look at the Table of Contents and note what page "From the Cockpit" begins. When they get to the page before it, they can close their eyes, turn the page and skip over "From the Cockpit."

ED LOWE
Holdingford, Minnesota

Mystery Modeler

I've been buying and reading *Model Airplane News* for over 30 years and it's my favorite. I think this is the first time I've written in and I wish I had something terribly important to say. The fact of the matter is that I'm one of those people that worry when they can't remember the last line of a song, the president's middle name, or the exact date they first flew R/C.

I've been worried lately because I haven't seen anything about one of my modeling heroes in your publication for a number of years and I want to know what happened to him. I can't recall his name but between 1960 and 1970 he was always reported as doing something weird at contests and some of the many antics still amuse me after all this time. He was reported as being a bit scraggly, had a lot of hair, and came from Schnieder's Swamp, Virginia. He was chubby, full of benign mischief, and was an expert in free flight. You mentioned him several dozen times and often had articles about him. I haven't noticed a single line about him for years now. I do hope the gentleman has not passed on. Do you know his name and present status? I'm really curious.

BOB SAXON
Oklahoma City, Oklahoma

Well Bob, I don't know who this mystery modeler is but if any of the readers know, I'd be curious to find out also. DBS

Big Gun Shoot-Out

I think you ought to be congratulated on your "Big Gun Shoot-Out."

I can't think of an article in a modeling magazine in the last few years that I have re-read as many times as this one while thinking, "Why hasn't anybody thought of doing a head-to-head test like this before?"

I feel the HB .61 PDP should have been included with the Schnuerles and I would have liked the non-PDP HB .61 with the Perry carb in the standard porting category.

I hope that you will be able (and willing) to do a similar article on all the .40 size engines on the market, as the 6.5cc engines are the most used (I think) class by the R/C fraternity.

RYK BEZEMER
Windsor, Ontario, Canada

We'll see about that. DBS

Editor's Flight-Line Review

by DAN SANTICH

Tatone Engine Test Stand

The Tatone Test Stand has been around for many years and thousands of modelers have benefited from its use. Sometimes, however, items such as this are taken for granted and their value is never really understood.

It's common practice today to take an engine out of the box, new, and install it in an airplane and go fly. Our engines can cope with that. Long break-in periods are the exception rather than the rule. The only problem with this is that it shortens the life of your engine! This is because the engine isn't given the chance to seat all of its parts under controlled conditions.

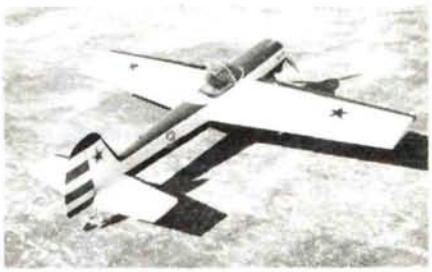
An aircraft in flight is constantly changing attitudes and positions. This creates an uneven fuel flow, and will make your engine run lean or rich, depending on the attitude of the airplane and the number of G forces it's undergoing.

The Tatone Test Stand eliminates this situation by giving the engine the chance to run under controlled conditions with regard to fuel tank location and attitude. It's also a handy way to check your engine for adjustments such as with four-stroke valve settings, etc.

The Tatone Engine Test Stand comes in two sizes: one for .09-.40 engines and a heavier model for .40s and up. They're very well made and will last a long time. If you don't have one you should.

The Tatone Test Stand is available from Tatone Products Corp., 1209 Geneva Ave., San Francisco, CA 94112.

Metterhausen YAK 55



Metterhausen kits are produced in West Germany and although it's a small company, they produce excellent products. The YAK 55 pictured here is a good example. It's a giant scale (3.5 inches = 1 foot) version of the popular Russian aerobatic design and one of the best flying, if not *the* best, semi-scale models I've ever owned.

Powered by a Sachs-Dolmar from T&G Manufacturing, this 22-pound model will do it all. Having a span of 88 inches and an area of 1,585 square inches, it's an impressive design that breaks the "sameness" dilemma found at most giant fun-flies.

The kit is beautiful! It has one of the finest fiberglass fuselages I've ever seen and the foam wings, which plug into the fuselage, are already sheeted with balsa as are the tail feathers. The landing gear is formed out of laminated fiberglass and is very strong. I know because I mounted over 10 pounds of camera equipment for aerial video work in it and, not only did the model still fly well, the gear held firm on a number of "hard" landings.

You can obtain more information about this and other Metterhausen kits from Kavan, Lindenaststr 56, 8500 Nurnberg 10, W. Germany. Drop them a line and see if we can't get a supply open from these kits; they're well worth the effort.

Each month model products will be reviewed personally by the editor. This will be a "hands on" evaluation wherever possible and these products will receive close scrutiny under actual operating conditions. These reviews do not constitute any recommended priority over an existing product of similar design or nature, but merely reflect the use of available items from your dealer or hobby shop.

Tech Tips **A little effort goes a long way.**

Basic Control Systems

by DAN SANTICH

THE PURPOSE OF this article is to aid the modeler who is just getting started in R/C in understanding how the controls on his model are activated, what to do and what not to do, and proper installation procedures. Once these skills are mastered you'll be able to apply them in almost any model.

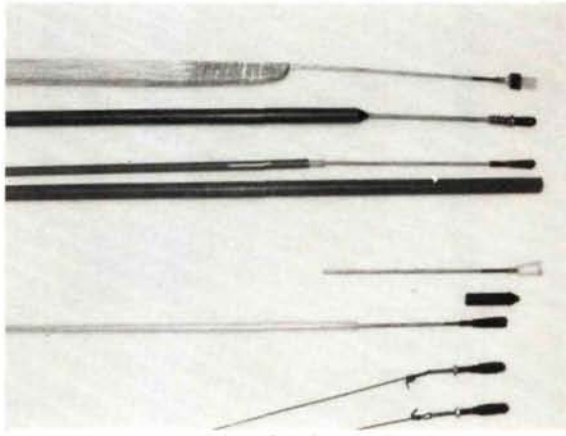
The control system of any airplane, meaning those surfaces that move on a given command, is the most important part of a radio-controlled model. Yet, it's one of the most abused and misused items in our models. The model that has a proper control setup will give many hours of pleasure, while the one that isn't will usually live a short life. Remember that every moving surface should have a minimum of air-gap between it and the surface it's mated to. It should move freely on the hinges, it should be warp-free, it should be resistant to twisting motions, and there should be no play.

The purpose of a control system is to activate or move the desired surface in the desired direction a desired amount. Call it control deflection or control movement; how it moves is up to you. It can be sloppy, tight, or just right, depending on your attention to this very important aspect of modeling.

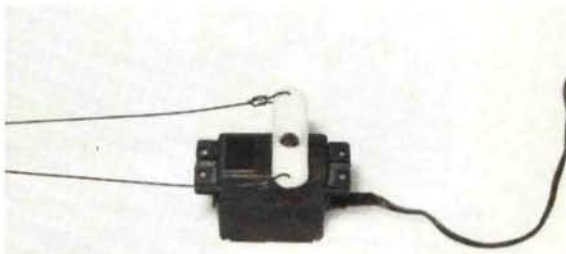
The amount of travel your control surfaces have is a matter of aircraft design criteria for the specific model you have built. If you have too much travel, the control surface will act as a brake or spoiler and actually stall the surface. Twenty degrees of travel from horizontal is usually more than adequate for any control surface. On trainer type airplanes it's usually less; about 15°. That isn't to say that you'll use this amount to fly the airplane, but it's the amount of travel necessary for attitude adjustment during power changes, climbs and dives, and mild maneuvers. Too much control travel, especially on a trainer, can make the model difficult to fly since small inputs on the transmitter make the airplane react more quickly and more violently than is necessary.

If the control linkage is sloppy your model will never fly the same way twice and it will be a handful in the air. If you can physically move the control surfaces more than ¼ inch up or down with your hand, you have too much slop. Slop creates dead spots in the action between the servo and the surface resulting in a loss of control input during that period. In other words, you can give a small amount of control on your transmitter and nothing will happen. Then, as you give more control, the surface will move all of a sudden and give you more than you wanted. If you've ever seen a model flying around like a yo-yo, chances are that plane had too much ply in the the controls. Too much slop also causes control surface flutter which can be fatal to your model. Flutter also causes serious damage to the gear train of your servos.

The components that make up a typical control system for one function, such as elevator, consist of the servo, output arm, pushrod, control horn, and control surface. The method of attachment from the servo to the control horn is optional, depending on the desired action, but is usually accomplished with either a clevis, Z bend, or several accessories available for specific purposes. The main part in all of this,

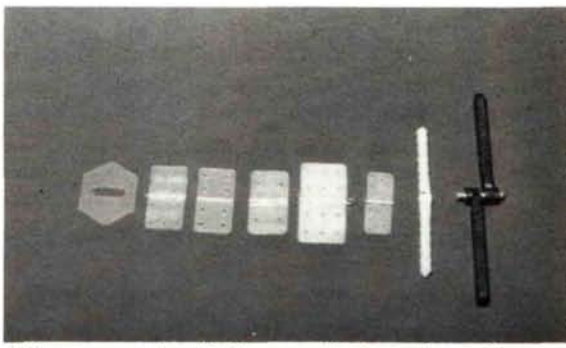


Control actuators, or pushrods, can be done in many different ways.



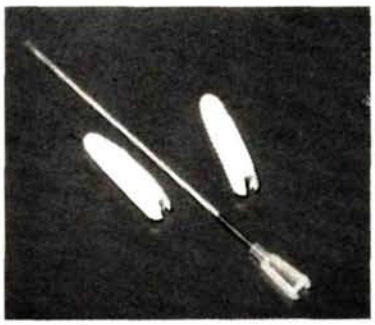
A closed-loop cable system is good for rudder control.

Cables attached to threaded couplers allow tension adjustment.



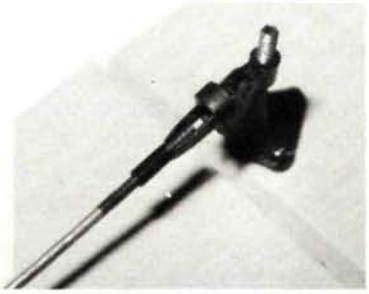
Hinges come in all shapes and sizes, depending on application.

Accessories available for control systems are abundant and useful.

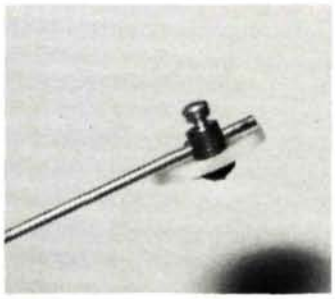


Pushrod exit guides help prevent bowing under stress.

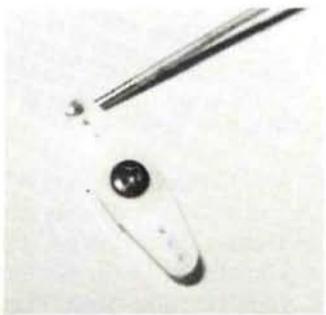
Any metal attachment points, such as throttle, should use a nylon clevis.



Some control horns have threaded rods to adjust control travel.



For servo output you can use an E-Z connector, above, or a simple Z-bend, below.



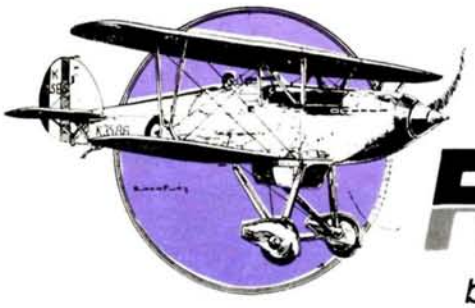
however, is the pushrod, which transmits the power of the servo to the control surface and is often a problem for some beginners.

Actually, a pushrod should be called a push-pullrod since that's what it does. Since the control attachment is usually on either side of the control surface, you have to either push it or pull it, depending on the deflection you want. A control surface that is pulled to any position by a pushrod is generally more effective since the chances of stretching a pushrod are remote. When you push a control surface with one of these things, however, you can see that there's a potential for less control than you thought was available. If the line from the attach point on the control surface to the servo isn't exactly straight, the pushrod will deflect or bow when any pressure is applied to the control surface end. And it's hardly ever possible to hook up an airplane with pushrods that are exactly straight. You usually have to make a bend at the rear end of the fuselage to get the rod outside to the control surface. Therefore, it's good practice to make the wire that comes off the pushrod as short as possible. The longer the wire is, the more chance you have that it will buckle when pressure is applied to it.

There are several different ways to make a pushrod and there are several different types you can buy. Since the use of pushrods is so diverse, with an infinite amount of different lengths needed, none of the commercial brands are pre-assembled. Commercial pushrods come in several different materials; some are glass fiber, some are carbon, some are aluminum, some are wood, and some are plastic.

Which are best? Good question! The best pushrod is one that will not buckle when control pressure is put on it. Any of the above work if properly prepared and installed. Just remember to make the attachment wire as short as possible; otherwise the best pushrod

(Continued on page 116)



Fifty Years Ago...

by DAN SANTICH

The cover painting by Joe Katula featured the Bleriot-Spad 510.

THE 1936 Nationals were held in July at the Wayne County Airport in Detroit, Michigan and the results were published in the September issue of *Model Airplane News*. This was the largest gathering ever for competition among modelers and also the largest gathering for gas-powered models to date, with over 190 contestants. Vernon Hoehle of Indianapolis, Indiana, brought the largest gas-powered entry, a 14-foot, 8-inch span model powered by a Baby Cyclone engine. It flew at an estimated 6 mph and garnered fifth place, while Ray Podolsky, Dick Bodle, and Melvin Yates took fourth, third, and second places respectively.

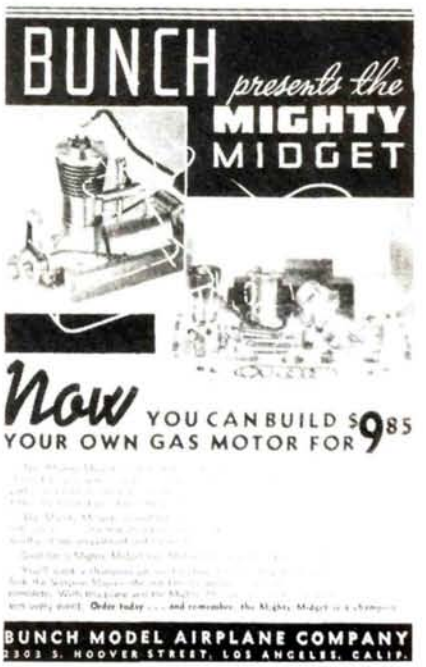
Top honors in the Open Gas event went to Michael Kostich of Akron, Ohio, with a record-breaking time of 36 minues, 52.2 seconds. Chester Lanzo of Cleveland, Ohio, won the Outdoor Cabin R.O.G. Open event with a time of 48 minutes, 45 seconds, and Francis J. Tlush, 19, of Lyndhurst, New Jersey, took home top honors in the Texaco event for "over 16 and under 21" with a time of 45 minutes, 34.5 seconds. Louis Casale of Syracuse, New York, won the Exhibition Scale Model contest with a score of 98 points.

A total of 433 contestants participated in the 1936 Nats; 78 were over 21 years old and 355 were younger. Fifty-five foreign competitors showed up, as did 6 women, for this contest.

Commercial aviation was opening up new horizons around the world for travel to places only dreamed about before. Pan Am was operating a giant Martin China Clipper powered by four 800 hp engines on its Pacific routes and the Douglas Transport was establishing a remarkable record for reliability and safety.

Boeing rolled out its new interceptor, the P-26 Peashooter.

The G.H.Q. Air Force was established on March 1, 1935, as an independent force under the command of Brig. General Frank M. Andrews, who was only responsible to the Chief of the Army General Staff. In 1936 the new air arm was headed by Major General Oscar Westover as Chief of the Air Corps with Brig. General H.H. Arnold as Assistant to the Chief. At that time, Air Force aircraft consisted of four fighter types (P-6, P-12, P-26A, and P.B.2A), six bombers (B-3A, B-4A, B-5A, B-6A, YB-10, YB-12, B-18, and YB-17), and three primary trainer types (PT-3, PT-11D, and PT-13).



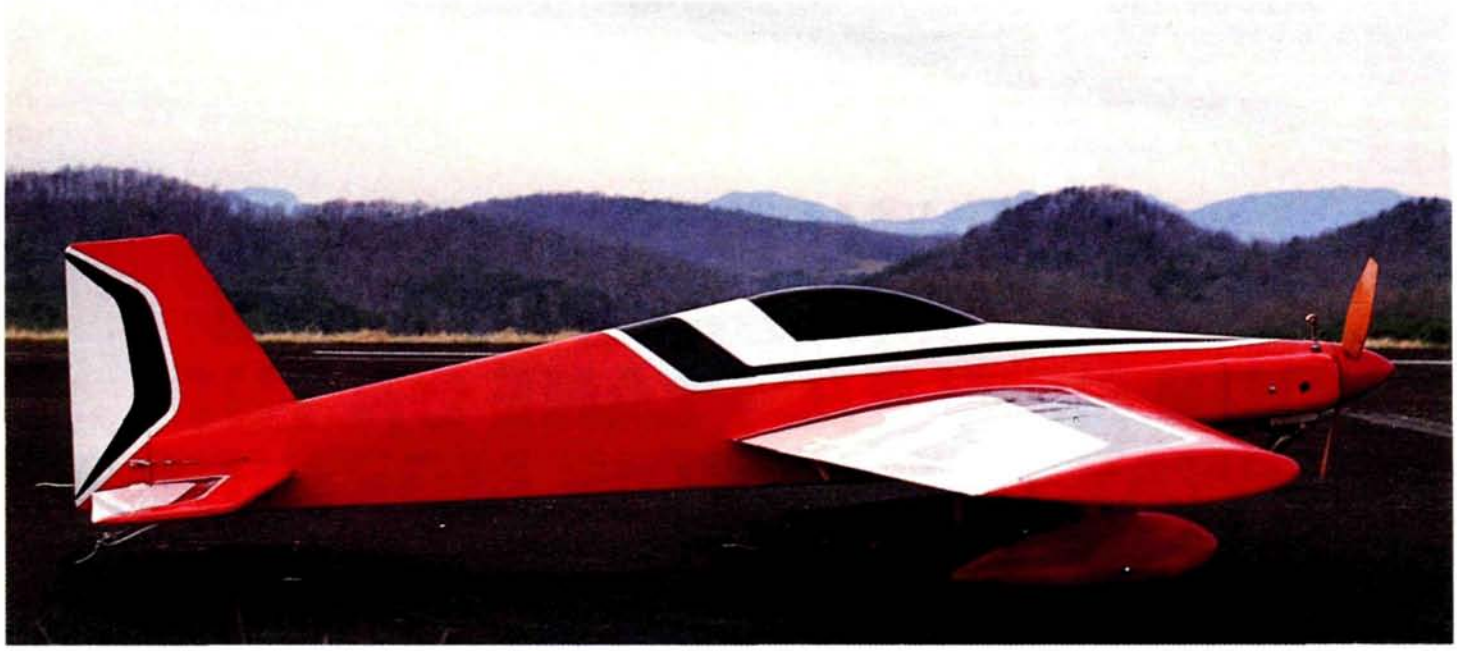
The Bunch engine sold for $17.50 ready to run or you could buy a kit for $9.95 and build it yourself.

Modeling in 1936 was primarily a youth-oriented activity; the creative fire was fueled by the exploits of heroes such as Howard Hughes, Jimmy Doolittle, Roscoe Turner, and Charles Lindberg. It was also a time of experimentation, new horizons, and adventure, and *Model Airplane News* was there to tell you about it, 50 years ago this month. ■

The 1936 Nats, held in Detroit, pulled 433 contestants.

Construction

Turn-A-Cat



by ROGER LUEBKE **A fine lined sleek ship for you sport fliers.**

FORMULA I raceplanes have to be among the most beautiful airplanes in the world. However, most of us don't fly them because they are too fast. But what if one could be built within the speed parameters of a Turn-around ship?

I built the Ole Tiger (from *M.A.N.* plan #9832) and was immediately impressed with the flight characteristics of this midwing centerline thrust arrangement. I took the configuration of the Pole Cat, combined it with the Ole Tiger and designed the Turn-A-Cat with approximately 850 square inches of wing area. The result is a fast looking airplane whether it's sitting on the ground or boring holes in the sky.

The most useful tool to use on this or any balsa-constructed airplane is a straight sanding board. I glue a strip of #36 sandpaper to a 24-inch aluminum level. It's useful in straightening whoop-de-do's and carving all straight parts.

As in all Turn-around ships, it's important to build light. Many areas could be reinforced but this is not advised. Use medium to light grade balsa, cyanoacrylate glue and mylar covering to produce a 7-pound bird. By drilling many holes in the vertical fin and fuselage, I'm sure you can bring the weight down to 6½ pounds.

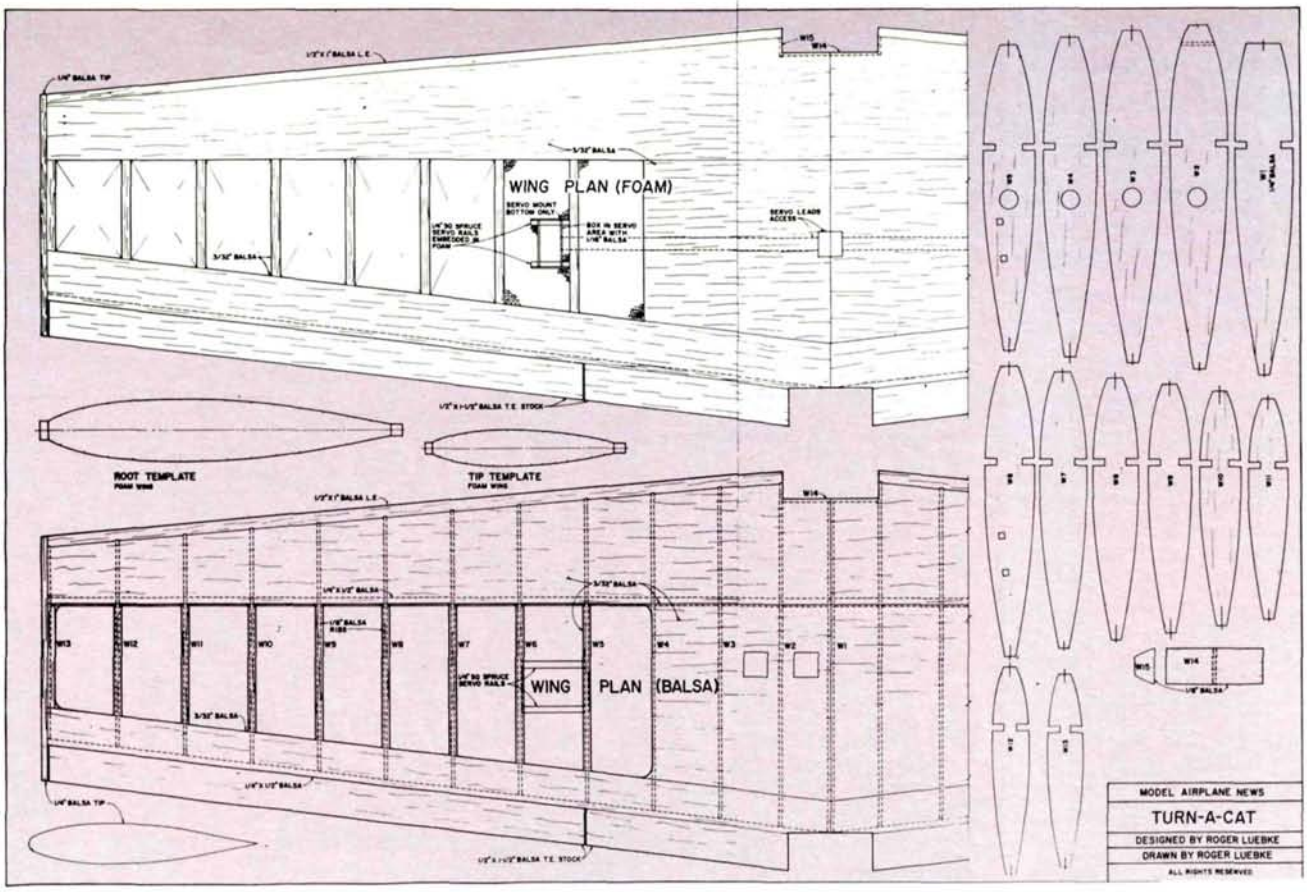
The prototype was built with fixed wings and the servos were mounted in the wing. The plans were drawn with the wings held on by the 3/32-inch plywood bottom. This is a bit different from the normal way of mounting wings but the engine vibration and torque are distributed throughout the fuselage much better this way. You could make plug-in wings but I think the above method will be lighter.

The wing is shown as a built-up balsa or as a balsa-

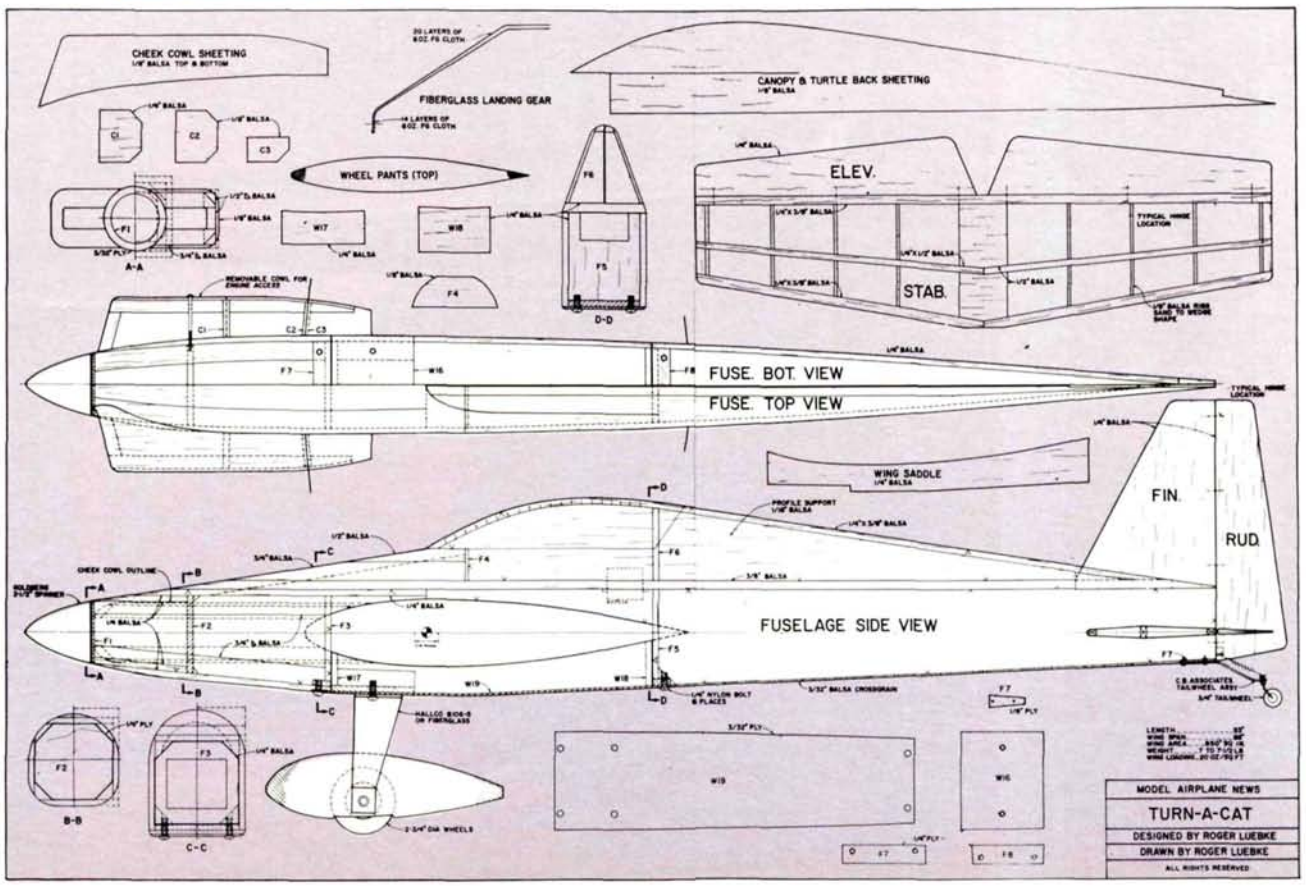
(Continued on page 107)

Structure is lightweight and strong.

Since the wing is non-removable, get it right the first time.



Type: *Sport*
Span: *66 inches*
Area: *850 square inches*
Length: *53 inches*
Weight: *7-7½ pounds*
Engine: *.40-.60 two-stroke*
.60-1.20 four-stroke



FULL-SIZE PLANS AVAILABLE...PAGES 122-123

1986 Clearlake Float-Fly

by JOHN SULLIVAN

I'VE BECOME complaisant enough to sleep through the night before Christmas, not to mention my birthday. I can even refrain from forcing the UPS van over to the curb to check on my latest shipment of balsa. But happily there's one event that still keeps me on the edge of my seat. It's the annual Clearlake Float-Fly, and this year, as always, being there was more than you could anticipate.

This year there was an unseasonable offshore wind with gusts up to 35 mph that rocked the docks and blew all day. If anyone came doubting the advisability of float flying in rough weather, they went away a convert by Saturday night. Of the 60 to 70 planes that went out, got swamped, dunked, finally airborne, buffeted, and then plunged into a swell on landing, only three didn't make the flight-line for Sunday's fantastic weather—and they were repairable.

The Catalina by Wally Rinker (above) was a real show-stopper. Photo at left is the famous Aeronca Champ in quarter-scale. Below: Danny Stanton prepares his Canadair for another flight.

The most successful planes came from two extremes of the spectrum: the swift ones with excellent penetration and power and the Old Timers and Telemaster types with lots of lift—even on downwind takeoffs—and the ability to flare back down like a kite.

The pilots put up a surprising variety of planes including Danny Stanton's Canadair Twin

Amphibian, Chris Dellinger's Delta North Star, Lee Palzolo's immaculate Waco Bipe, Gary Korpi's Lake Buccaneer, Bill Curry's Neuport 28, Gary Emerson's pattern ship, and on and on. The 100-plus aircraft on the flight-line proved one point: you can put anything that flies on floats and *double* its appeal.

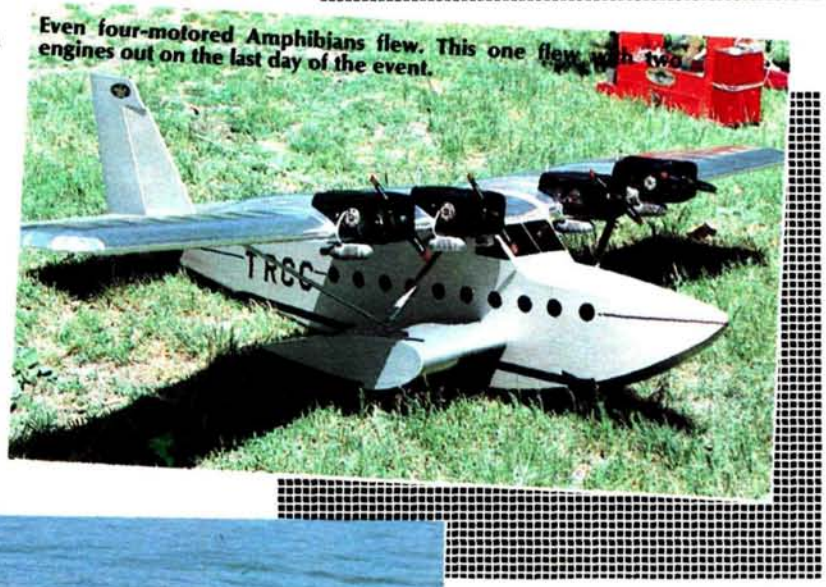
The heads-up winner had to be the phenomenal 81-inch Super Widgeon Amphibian scratch-built by Irwin Ohlsonn (remember Ohlsonn and Rice?) and flown by Joe Bridi. It was powered by counter rotating Kraft 60s (still made by RJL) with Perry Pumpers, Zinger 11x7½ props, and a 500cc tank in each nacelle. This twin-engined screamer stopped the show every time it flew. The sight of Joe Bridi in a straw hat, nonchalantly leaning against a piling with the deck heaving under his feet while piloting the Super Widgeon full bore, 5 feet off the water, will never be forgotten.

There was one other sight that a couple of pilots probably wish they could forget. Rich Irwin's Sopwith Pup and Bob Francis' Citabria collided mid-air on Sunday. The sound of those two ¼-scale ships chewing each other up and the silence that followed had everyone running to the beach. It took a minute for the last piece to hit the water. There was some good news, however. Francis already had a new wing framed up from the Citabria and his fuselage wasn't in too bad a shape. Irwin sold what was left of the Pup for $30 and then bought Bud Crane's soaked Neuport 11 for $50.

A very special note of thanks is in order for the Clearlake Modelers; C.D. Bill Gresham, District 10 Frequency Coordinator George "Stiener, IMAA V.P. Ken Runestrand, retrievers Ron Trammel and Bill Bullis, the 91 pilots who registered 110 planes, the city of Lakeport, and the roster of over 50 local merchants and model manufacturers who contributed to this fantastic event.

One of the few frustrations in writing a float report is that words alone can't convey the pleasure derived from this very special aspect of our sport. So I'm going to cut short my usual avalanche of words so there's room for lots of pictures. Check out "Floating Around" and give float flying a try. Once hooked, I guarantee you'll never look back. ■

Dick Hershey took three years to complete his Douglas World Cruiser. The results show it.

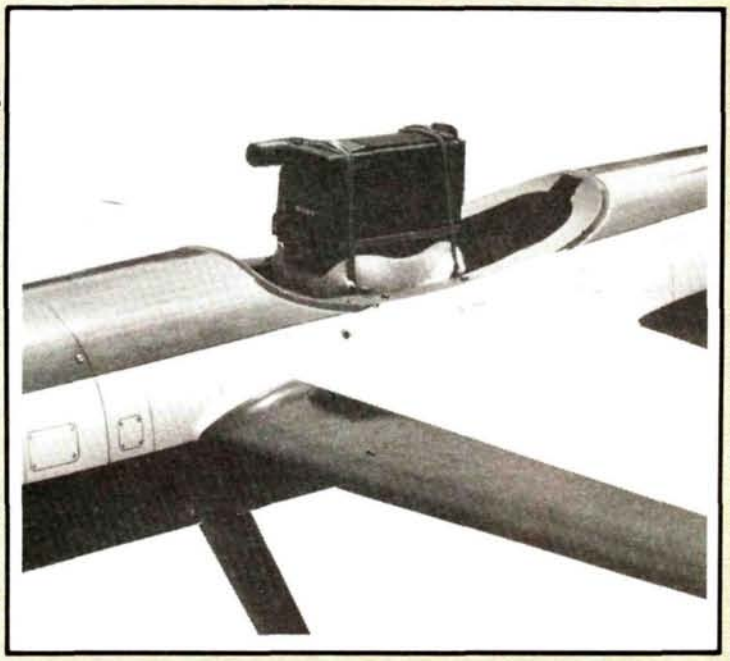


Even four-motored Amphibians flew. This one flew with two engines out on the last day of the event.

Jim Hill's Clip-Wing Cub from the Sig kit had an O.S. 1.60 Twin four-stroke for power. Weight was 17½ pounds.

Onboard R/C VIDEO

by DAN SANTICH



Modeling can be a great thrill, especially from the view of your model. It's just like flying the real thing.

FLYING R/C MODELS is a lot of fun. Of course, since I'm a pilot I also enjoy flying the full-size versions when I can. It has often been said that modelers are pilots in another dimension; their feelings and inspirations are a parallel sensation. The only difference is perspective.

I have a love for the air! There is just something about being above the ground that excites me, intoxicates my awareness, and gives me another reason for appreciating the gift of being alive.

When you're in an airplane, especially a light aircraft, you're out of your element. Humans were not designed to fly! But with our ingenuity we have created the means and the enjoyment derived from it can only be described as out of this world.

Our senses become confused at first but they readjust quickly and tune into this new environment. When we decide to push that level with new motions, such as loops, rolls, spins, and other maneuvers, the sensation can be exhilarating or sickening. But it's fun; just like a roller coaster at an amusement park is fun. That's why we do it. Because it's fun.

I've always wanted to climb inside my models and go for a ride. Perhaps that is the hidden reason for my enjoyment of the hobby. I'm living a fantasy, or at least trying to. When I take off, do a loop, or a smooth roll, I try to place myself in the cockpit. Don't you? Can you imagine what it's like?

I decided to find out and I can tell you that it's even more fun, more exciting and more exhilarating that I ever imagined. How did I do it?

The world of electronics and gadgets is wonderful. You can have almost anything you want in some kind of electronic gizmo—home computers and VCRs are commonplace. Having enjoyed my own VCR for some time, I became interested in making my own VCR programs—home movies, if you will. For this I needed a VCR camera. My intention was to use the camera at contests and fun flies, as well as documenting product reviews.

Sorting through the available VCR cameras on the market lead me to the Panasonic PV 200. It's a battery-operated, versatile unit that has zoom and macro capabilities. Like most amateurs, I spent a few hours trying to figure out how it worked and shot a lot of footage on silly things. But I was getting the hang of it.

I took it to the club flying field and got some footage of the guys flying, working on their models, crashing, and the other things that usually go on. The PV 200 has an immediate playback capability so we all enjoyed seeing what had been shot only a few minutes prior. Then I had a brainstorm. Why not put this camera in my airplane? My excitement abounded.

I quickly fabricated a mount for it in the cockpit area, set the camera for operation, checked the CG, and took off. I've never been the same since!

The first flight was just to see if it would work and what the quality of the film would look like. When I landed the camera wasn't running and my hopes were dashed, temporarily. I ran the tape back and viewed what I had just filmed on the camera monitor. I was spellbound.

Since the playback within the camera doesn't have sound capability, it was like looking at a silent movie (the playback is also in black and white). But the effect of the visual image before me had me jumping up and down. I had never seen anything like it before. The realization that the film I was watching was just shot from my model airplane gave new meaning to the hobby for me. Not only could I design, create, and fly my models but now I could actually get inside and go for a ride! And what a thrill it is.

After the first success, I began to think of the possibilities and the choreography required to make an entertaining film. I enlisted the help of some fellow modelers to fly aerial combat. We arranged our flight schedule like a crew about to go on a mission. Ceasar Latte was the enemy. He took off in his Lance Bandit and I soon followed. I chased him around the sky, picked him up in my sights, and let go with a burst from my 50 cals. He went down in a plume of smoke. After that I peeled off and straffed everything in sight, including the flying field. Then I put on an aerobatic display with the smoke system going and the camera pointed at the tail.

Since the camera I used also has sound, the engine

(Continued on page 80)

Sig Manufacturing

by BURNIS FIELDS

Morrisey Bravo

A unique homebuilt for the giant-scale crowd.

SPECIFICATIONS

Type: *Giant Scale*
Span: *86 inches*
Engine: *1.3-3 cubic inches*
Area: *1,375 square inches*
Weight: *19¼ pounds*
Channels: *4*

CLAUDE MCCULLOUGH has always had an eye for scale models. It seems that he is always looking for that "perfect" airplane. On a recent trek to the EAA Fly-In at Oshkosh, Wisconsin, as usual, he had his camera and was snapping away. That's when it happened. There, staring back through his camera lens was the beautiful Morrisey Bravo, white and silver with black numbers and pin stripes. Claude knew that this would be his next scale effort.

The Bravo was designed and built by Bill Morrisey, a noted engineer with Douglass Aircraft, as a retirement project and as a step-by-step kit for homebuilders which he produces

in kits at the North Las Vegas Airport.

THE KIT. This Sig* kit is big and beautifully packaged. The wood is high-quality Sig balsa and spruce, straight and true. The die-cut parts are sharp and crisp. The cowl and wheel-pants are high-quality epoxy glass. The only ABS plastic parts are the wingtips and the tailcone which only take a few minutes to assemble.

The kit is complete with lots of hardware that includes a C.B. tailwheel assembly and all necessary screws, nuts, and 4-40 clevises.

CONSTRUCTION. The instruction book is excellent with lots of very clear pictures. For power you can use anything from a 1.40 to a 2.70 four-cycle.

The model is not hard to build but I do recommend that you follow the instructions very carefully.

I used cables for the rudder control instead of the control rod provided. I did this because it's positive and light. I sheeted the wing because I wanted to add rivet detail.

My Bravo is covered with Sig Koverall, which I applied with Sig Stix-It, a heat-activated adhesive. Fantastic! I finished the covering with Sig white and light red dope, and topped it with four coats of clear.

A very large sheet of decals is furnished with the kit. This decal sheet is for the silver paint job. If you wish to do the new red paint job, a special decal sheet can be purchased from Sig.

FLYING. How does it fly, you ask? To tell you the truth, I would not hand this to a beginner. But a person who has flown low wing aircraft and is familiar with tail draggers should be in love at first sight. My model, with the big Saito 2.70 four-stroke up front is a real mover. Takeoff is a half-throttle maneuver; at full throttle this 19¼-pound baby will jump into the air like a scared quail. The Bravo's flight path is extremely smooth and precise. Loops are big and beautiful and four-point rolls are crisp. I give a lot of room for outside loops. Ground handling is excellent and takeoffs are very easy. Landings are also easy but get the throttle off on the down-wind leg or she might fly right on past the runway.

To sum it all up, the kit is very high quality. The parts fit nicely, there is plenty of hardware, and the wood is the finest. Flying is a thing of joy.

**The following is the address of the company mentioned in this article:*

Sig Manufacturing Company, Inc., Montezuma, IA 50171. ■

Hazel Sig Hester shows off the new Sig kit which is a very accurate rendition as can be seen when compared to the full-size Bravo.

Bravo

AN EXCITING NEW two-place home-built sport plane has been seen roaring through the skies over the Iowa cornfields. At the controls you see Hazel Sig or Maxey Hester of Sig Manufacturing Company. More than likely, you'll see big smiles on their faces because they're experiencing the thrill of owning and flying an airplane called the Morrisey Bravo.

The Bravo was designed by William J. Morrisey after a visit to the annual EAA Convention in Oshkosh, Wisconsin. He liked the looks of many new home-builts, but after finding out that he couldn't fit his relatively large frame into the backseat of a Rutan Vari-Eze, he decided that he needed a wider, more comfortable airplane. The next week he started doodling.

Bill Morrisey learned to fly in the 1920s in a Curtiss Standard biplane powered by an OX-5. During World War II, he served under the famed race pilot Benny Howard as a production test pilot at Douglas Aircraft Company. Later promoted to Chief Test Pilot, Bill's most notable achievement at Douglas was making the first test flight of the C-124 cargo transport. In 1947, during his stay at Douglas, Morrisey built his first light plane design. Everyone thought it was a "nifty" little airplane so it became known as the Morrisey Nifty.

The Nifty had a welded-steel fuselage, a wood wing, and a 65 hp engine. Plans for the Nifty were made available to home-builders for a short time. The wing, tail, and aft fuselage were later redesigned to be built of aluminum. This new aircraft was called the Morrisey Model 2000 and was type certified by the FAA in 1955. Bill made some alterations to the Model 2000, including replacing its 90 hp engine with a 150 hp Lycoming. That resulted in the Morissey Model 2150 (Model 2000 plus 150 hp) which was type certified in 1957.

The Model 2150 was produced during 1958-59 by Morrisey Aviation of Santa Ana, California. Morrisey built ten 2150s then licensed Shinn who went on to build 35 more during 1961-62. Bill later sold the rights to the 2150 to George Varga of Chandler, Arizona, who produced almost 200 airplanes as the Varga Kachina. It's interesting to note that through all its years in production, the Model 2150 remained virtually unchanged, except for a few Kachinas that were fitted with 180 hp engines and converted to taildraggers.

The Bravo Model OM-1-2 ("OM" stands for "One More" airplane, "-1-2" means one or two seats) first flew as a single-place aircraft with an open

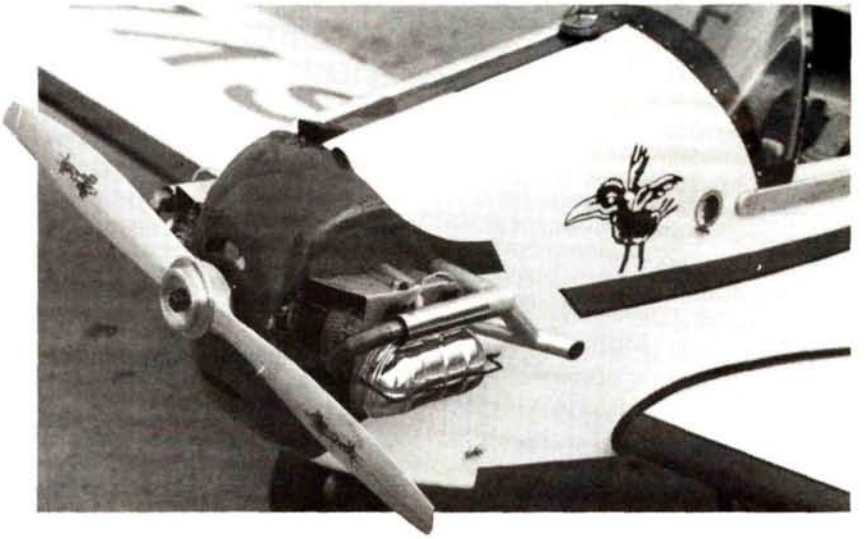
(Continued on page 104)

by BRUCE A. THORPE

It's what's up front that counts!

Propeller Efficiency

by CARL RISTEEN



MOST MODEL ENGINES are vigorous little wasps that like to turn at extremely high rpm to develop full power. This tends to be bad for propeller efficiency due to high tip speeds, but also due to the relatively low ratio of pitch to diameter, particularly for the larger, slower models.

Propellers are most efficient with a pitch-to-diameter ratio of one or higher, with 1.3 being the ideal. Control-line speed models and pylon racers come off well here, but the larger R/C models with glowplug two-stroke engines suffer. To retain the desirable high power-to-weight ratio of the high rpm engines, a reduction drive can be worthwhile.

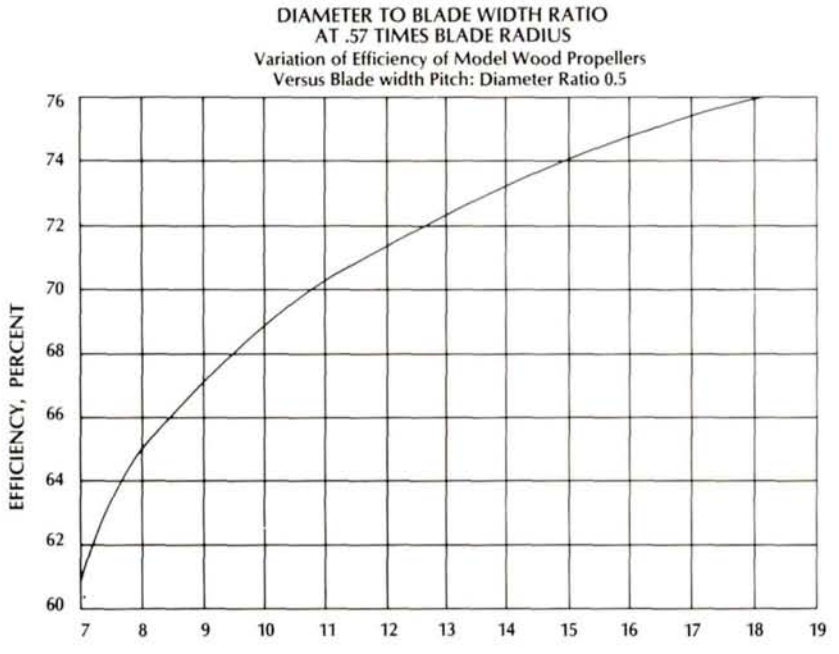
I did a considerable amount of paper-scratching to calculate the best engine/propeller combination for the new Turnaround pattern rules. To those attracted to mechanical devices, the reduction gear engines are very intriguing and the rule permitting 1.20 cubic-inch four-strokes and the tough noise limits really got the stew cooking regarding powerplant and propeller selection.

The direct drive .60 engine with a tuned pipe is the lightest and most powerful powerplant, if you can get it quiet enough. My own work performed to date indicates that a really quiet pipe tuned for slightly lower than absolute peak horsepower rpm, a slightly larger prop, and a cowled engine will meet the noise requirement.

Would the extra propeller efficiency of a geared .60 or 1.20 four-stroke offset the additional weight, and in the case of the four-stroke, the power deficit?

An 11x7½ prop will reach a peak efficiency of about 75% at an optimum airspeed of about 110 mph at 16,500 rpm in the air. This might be too fast for Turnaround but it will serve for comparison. A 1.9 reduction ratio will need a 16x14 prop for the same airspeed and will give a peak efficiency of about 80%. The 5% gain actually represents about 6.7% more thrust at a cost of 8 or more ounces of additional weight. I compared efficiencies at lower speeds, corresponding to acceleration and climb, with about the same results; about 6% to 8% more thrust at 60 mph in favor of the geared engine. The geared unit just doesn't seem very worthwhile at 60 to 110 mph pattern speeds. The geared prop would be expected to show a worthwhile advantage on a large, draggy, scale model flying at 40 mph requiring a 13x6 or 14x4 prop direct drive, or an 18x8 prop at a 1.9 reduction ratio. The geared prop would be about 60% efficient at 40 mph, while the direct drive unit only reaches about 50%, a 20% thrust advantage in favor of reduction gearing. The ideal reduction ratio for a 15,000 rpm .60 would be 3:1 or more at 40 mph.

I do think that the 1.20 cubic-inch four-stroke engine has a great potential in Turnaround pattern, particularly as development might be expected to push



horsepower up to, and perhaps beyond, the level currently attained by the piped two-strokes, although the two-stroke is by no means a stationary target, horsepower-wise. In the motorcycle racing world, the two-stroke versus four-stroke battle has more or less settled down with the two-strokes showing about a 50% superiority in specific output. It might be reasonable to assume that the 1.20 cubic-inch four-strokes will reach this level, indicating a 33% power advantage to the four-stroke, and the game will be over for the two-stroke, unless the 2:1 displacement advantage given by the current Pattern rules is reduced to 1:5.

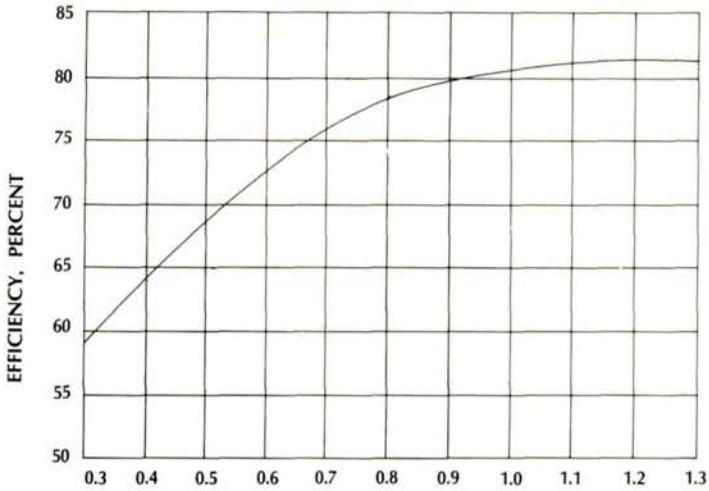
The power absorbed by a propeller is very closely proportional to the rpm raised to the third power. This helps to explain how a seemingly insignificant few hundred rpm can have such a large effect on performance. A 3% change in rpm indicates about a 9% change in power. Similarly, if you have a model that will stay airborne at only 30% of full rpm, you're flying at only .30 to the third power, or 2.7% of full power.

Power absorbed is also proportional to the fifth power of the diameter for propellers of the same shape and blade angle. It's also approximately proportional to the fourth power of the diameter, if pitch is held constant. If diameter is held constant, power is approximately proportional to pitch.

Thrust and torque are both proportional to the second power of rpm, and the fourth power of diameter for propellers of the same shape and blade angle. With the aid of a pocket calculator you can combine these relationships and turn them around in various ways to find the effect of changing diameter, pitch, and rpm at the same time.

PITCH:DIAMETER RATIO

Efficiency Versus Pitch: Diameter Ratio
Two blade model wood propellers with diameter to width ratio 15:1; thickness 10.7 percent



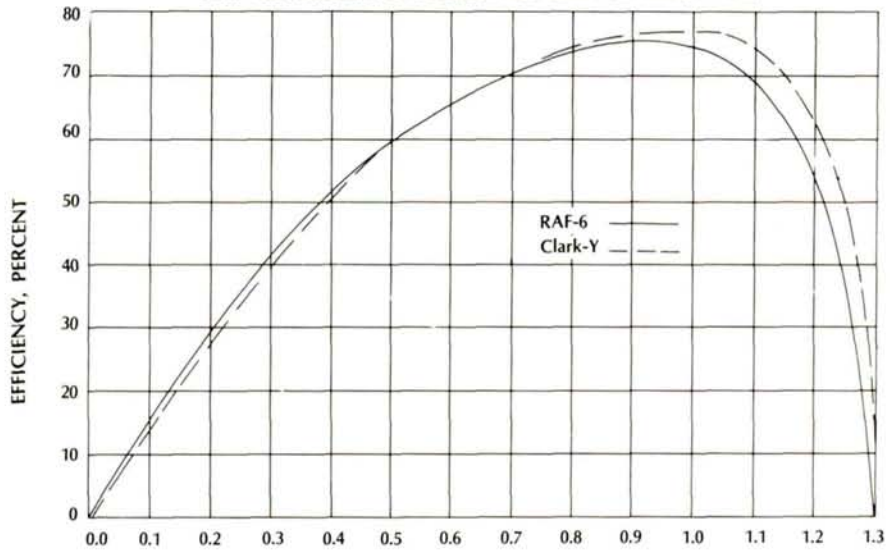
Scale modelers are sometimes faced with having to fly a model with a propeller less than twice the diameter of the radial engine cowl behind it. This isn't as bad as it might appear. Tests were conducted with smooth, blunt fuselages of 0.40, 0.60, and 0.75 times the propeller diameter. Propeller efficiency losses were 2%, 5%, and 7% respectively. In flight, the propeller acts as if it's working in slower moving air than the actual airspeed as the streamlines diverge before the propeller and then are crowded together along the fuselage. Best efficiency was reached with about 3%, 5%, and 7% lower pitch respectively with diameter increased accordingly, than operation at the test airspeed would indicate with a more normal fuselage width. Considering that the largest test fuselage would be equivalent to only 1½ inches of a 12-inch prop extending beyond the cowling of a scale model, the loss of only 7% doesn't seem too bad. Since it represents a reduction from about 75% to 68% efficiency, the actual thrust loss is more like 10%. For pusher props, the losses are about 50% to 60% more than for tractor props.

Recently I've noticed a tendency by manufacturers to rate large engines in

(Continued on page 101)

ADVANCE PER REVOLUTION AS FRACTION OF NOMINAL PITCH

Comparative Efficiency of Model Wood Propellers With Pitch:Diameter Ratio of 0.7 Versus Advance Per Revoultion With Clark-Y and RAF-6 Airfoils.



COMMON PROPELLER AIRFOILS

R.A.F.-6 TYPE

Good all-around section

Good performance in climb

Good for high-pitched props

Easy to make

CIRCULAR ARC TOP CHORD TYPE

Found slightly superior in some English model propeller tests to R.A.F.-6 type sections

CLARK Y TYPE

Good for low pitched props

Better efficiency than R.A.F.-6 type at full speed, sligthly inferior in climb

How To Get Started In R/C Soaring.

by JOHN LUPPERGER

One of the best thermal sailplanes, the Pierce Aero Paragon, spans 118 inches.

SOARING! The term brings to mind a sense of freedom and grace. Perhaps these visions are what keep us spellbound when watching a hawk, an eagle, or even a buzzard as they soar effortlessly, high above us in the sky. Circling, moving from one thermal to another, and almost never flapping their wings, they are totally in tune with themselves, nature, and their environment. When you master the technique of flying your model sailplane then you too can enjoy the freedom of soaring with the great birds.

Now that I've pondered the philosophical reasons for flying model sailplanes, what about the more practical reasons? Why should the beginner choose to fly sailplanes over powered models? There are three good reasons for making this choice.

First, since model sailplanes don't use engines, they don't make any noise. This makes it easier to find a place to fly them. In our urban society it's very difficult to find an open field or school yard that isn't flanked by houses. With your silent sailplane and a hi-start, chances are that these flying-field neighbors won't mind or even be aware of your presence.

Second, sailplanes are less expensive than powered models. With a sailplane there are no wheels, engines, fuel tanks, props, glowplugs, fuel, etc., to buy. All you need is a sailplane, a radio, and a hi-start.

The best way to practice is to do it. Spot landings are part of the confidence-building skills required.

Last, sailplanes offer the easiest way to learn to fly radio-controlled models. Since they are usually larger, lighter, and slower flying than most powered models, they give the beginning pilot more time to react to what the model is doing.

If you've read this far you have pretty much made up your mind that sailplanes hold a certain appeal and are right for you. The next decision you must make is whether you want to try slope or thermal soaring. For the purpose of this article I'll assume you've chosen thermal soaring.

Most soarers would say that the first item to purchase is your glider, but I think the beginner should choose his radio equipment first. If you buy and build your sailplane first, you may find

The Airtronics Olympic II is a fine example of a 100-inch thermal airplane.

An excellent choice for the beginner, the Gnome 2M is built to take the abuse of learning.

yourself having to purchase a radio to fit your model. If you've saved up for a radio it can be a real let down to find out it won't fit in your particular model. There's a wide selection of models available and if you have your radio gear when you go to purchase your model, you can check its fit against the plans.

The best radio buys today are the basic four-channel units such as the Futaba* 4NL Conquest, the Airtronics* SR4, or the Hobby Shack* Cirrus 4XL. The day of the two-channel glider radio is long gone. Since most of the two-channel units that are available, or have been available in the past, aren't equipped with nickel-cadmium batteries, their low price can be deceiving.

With the four-channel units you'll get three or four servos, nickel-cadmium batteries, and a dual charger for about the same or less than the cost of a two-channel unit and a nickel-cadmium conversion. You also get the advantage of two more channels and in many cases, servo reversing, which can really simplify your radio installation. Always read your radio instructions through a couple of times to make sure you understand its use and care completely. A few minutes of reading can save you all kinds of problems later on.

A good thermal training model must be easy to build, stable, and relatively easy to fly. It must be strong enough to stand up to the abuse it will receive

during training.

There are many good kits on the market that will fit these parameters. The beginner should start off with a two-meter glider such as Mark's Models Wanderer or Goldberg's* Gentle Lady. Both of these models are very easy to build, lightweight, and easy to handle. They are quite maneuverable and this can be a real bonus when the fledgling pilot gets into trouble. These gliders both have single-spar, open structure wings that are very simple to build and are best suited for use on a standard hi-start or up-start.

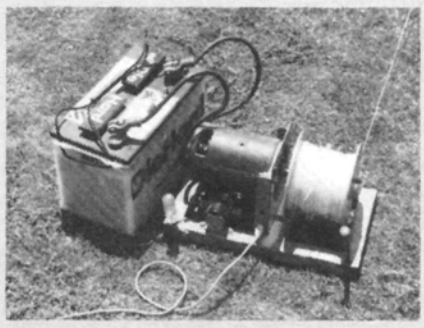
If you're going to be launching from a winch, then you would be better off with a model that has a twin-spar, open structure wing. This type of wing can better withstand the stresses encountered when launching from a winch. Some of the models that fall into this category are Craft-Air's* Stepp Two and Drifter II, House of Balsa's* Pussycat, and Airtronic's Olympic 650. Like the Wanderer and Gentle Lady, all of these models have polyhedral wings and although they involve a little more building they don't present any real problems for the beginner.

However, if the beginner possesses some basic building skills, the best choice is a model with a full D-tube wing. This kind of wing has two spars, shear webs, and is sheeted from the leading edge back to the spars. It's the strongest type of wing and can handle more abuse than the models previously mentioned. A model with this type of wing can handle even greater stresses during launch and can be launched on most 12-volt winches without fear of wing failure. The biggest problem is that most two-meter gliders with this type of structure are of the high-performance variety and aren't suited for the beginner. The Gnome 2M is about the only two-meter glider with this type of structure that still possesses all of the qualities necessary for a good trainer. It has a relatively thick airfoil which allows it to fly slow enough for training but it will still penetrate when the wind comes up and grounds most other trainers.

Now, after telling you all about the two-meter gliders there are to choose from, I'm going to suggest that you start with a 100-inch or larger model. Most people start with a two-meter glider primarily because of cost. The larger models cost more and since the beginner's first model is going to take a lot of abuse, most beginners elect to spend as little money as possible. This is sound thinking, but the bigger models are easier to fly and because of this they usually don't receive the same abuse as their smaller counterparts. Another advantage of the larger models is that they will generally yield longer flights than the two-meter models in the same air. This additional flight time is a big advantage when learning to fly.

Contests teach new skills as well as having social benefits.

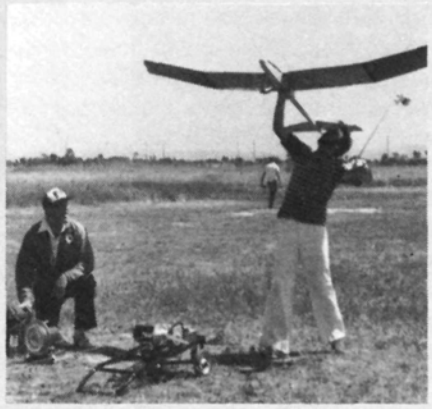
This modified Gnome 2M has flaps. Proper launch technique is essential.



A typical 12-volt sport winch can be used for various size sailplanes.

Airtronic's Olympic II, Craft-Air's Windrifter, and Pierce Aero's Paragon are the favorites in this category and have been training new pilots for many years. They are all high-quality kits that are worth the few extra bucks. With a larger model, you'll learn to fly quicker and, if you're lucky enough not to destroy it while learning, you'll have a sailplane capable of contest performance when you're ready for competition.

There are several ways to finish your glider. The two most popular coverings are the plastic iron-on and cloth iron-on varieties. Of all these types, Top-Flite's* MonoKote is the most popular for gliders. It's relatively easy to apply and imparts additional strength to the model's airframe without adding very much weight. If you follow the instructions (you know, those things that most of us throw away immediately?) it isn't difficult to get a respectable looking finish on your first try.



John Lupperger shows the proper launching form. Note the upward angle of the fuselage and level position of wing.

An important point to remember on your first model is to keep the finish

simple. We would all like our first model to be beautiful, but you must keep in mind that your first model is going to get banged around a bit. A simple finish is much easier to patch up when necessary (and it will be necessary). Do the fuselage and rudder in one color, and the wing and horizontal stab in another color, except for the right wing tip. This should be the same color as the fuselage and rudder to aid you with orientation when the model is at high altitude or when it's far away at lower altitudes.

Installing your radio and pre-flight checking is all that's left. When installing the gear follow both the radio manufacturer's instructions and the radio placement as shown on your model's plans. After your radio is installed check the model's balance against the plans and add lead to the nose until it balances perfectly. Check all your pushrod runs and make sure everything operates smoothly and that the control surfaces move in the right direction.

At this point you come to the most important step of all. Get an experienced glider pilot to test glide and trim your model. An entire article could be written just on the basics of learning to fly. The best thing to do is join a glider club and hook up with a good instructor.

Once you've mastered the basics of flying, the real fun begins! Radio-controlled soaring offers many varied challenges. Besides just improving your flying skills, there are the challenges of flying scale sailplanes, cross-country racing, multi-task events, contest flying, slope soaring, and hand launch gliders. And don't forget the greatest challenge of all, soaring with the great birds!

**The following are the addresses of the companies mentioned in this article:*

Futaba, 555 W. Victoria St., Compton, CA 90220.

Airtronics, 11 Autry, Irvine, CA 92718.

Hobby Shack, 18480 Bandilier Circle, Fountain Valley, CA 92728.

Goldberg Models Inc., 4733 W. Chicago Ave., Chicago, IL 60651.

Craft-Air, 6860 Canby Ave., #120, Reseda, CA 91335.

House of Balsa, 20134 State Rd., Cerritos, CA 90701.

Top-Flite Models, Inc., 2635 S. Wabash Ave., Chicago, IL 60616 ■

Aileron: The moveable control surface at the tip of each wing to control the roll axis of the model.

Airfoil: The cross-sectional shape of the wing from the leading edge to the trailing edge.

Angle of attack: The angle of the wing to the relative wind or air flow.

Ballast: Weight which is used to increase the wing loading, usually added at the center of gravity.

Center of gravity: The static balance of a model.

Channel: A single function of a radio used to control some action of the model.

Dihedral: The angle of the wings above horizontal when measured at the tip.

Elevator: The horizontal tail surface which controls the pitch axis of the model.

Flaps: Control surfaces located at the trailing edge of the wing used to increase lift and drag.

Hi-start: A launching device made up of a length of surgical tubing, monofilament line, and a parachute.

Incidence: The angle between a flying surface and the datum line of the fuselage.

Lift: Upward moving air such as that encountered within a thermal, or the force produced by an airfoil moving through the airstream.

NiCd: Nickel-cadmium rechargeable batteries.

Pitch: The longitudinal axis of the model controlled by the elevator.

Polyhedral: Wing planform layout with dihedral at the center and/or the tips.

Rudder: The vertical tail surface which controls the yaw axis.

Servo: A device that translates the radio signal to control a function of the model such as the rudder or elevator.

Spar: The main load-bearing structure of a wing.

Spoiler: The control surface located on the upper side of the wing used to reduce or spoil its lifting ability.

Shear web: Structure located between the spars to increase the wing's strength to withstand shear and compression loads.

Stall: When the model's wing can no longer support it in forward flight due to an extreme angle of attack or loss of lift.

Thermal: Upward rising air caused by the warming of the ground or other heat-producing sources.

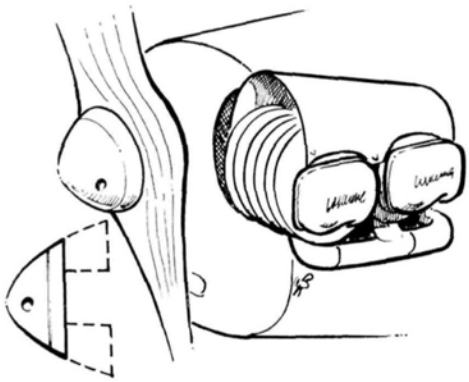
Wing loading: The ability of the model's wing to support a given amount of weight over a given area. Determined by dividing the model's weight by its wing area, expressed as ounces per square foot.

Yaw: The rotation about the vertical axis controlled by the rudder.

Hints & Kinks

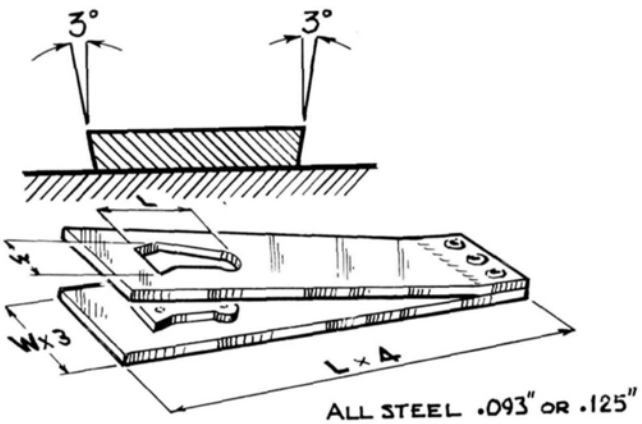
by JIM NEWMAN

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send rough sketch to Jim Newman, c/o **Model Airplane News**, 632 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.



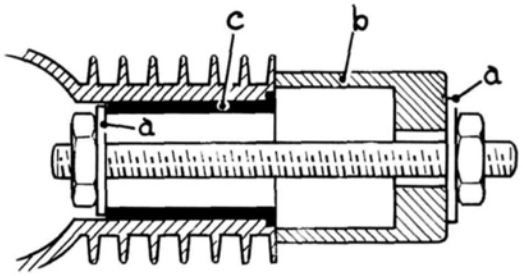
This modeler was looking for a convincing "skull cap" spinner to finish off his quarter-scale Cub. He hit on the idea of removing the skirt from a screw-on spinner, which then fit nicely against the face of that big propeller. Painted silver, nobody realized it was a very ordinary spinner at the start.

Chuck Jones, Chesterton, Indiana



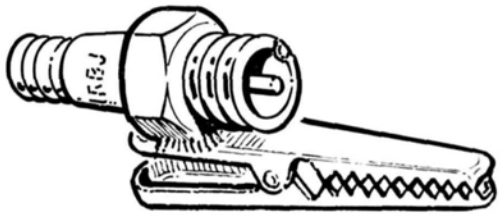
This is a Squeeze Die—great for the repetition of identical parts such as scale hinge brackets. Make in the proportions shown, riveting or soldering the male portion to the bottom die plate. Rivet the ends together then place the material between the die plates and squeeze in a vise until a click is heard. 4130 grade steel from the homebuilt aircraft supplier is an excellent steel for this tool. Note the 3° clearance around the male die. The scrap drop-outs make a first-class drill jig since the parts nest perfectly! Samples sent to me made from printed circuit glass board and aluminum were perfect.

O.R. Alexandersen, Kobenhavn, Denmark



An assortment of flat hardware washers (a), a long bolt or threaded rod and nuts, with a socket wrench (b) as a spacer will draw any stubborn cylinder sleeve (c) with little effort.

Richard Byrd, Ft. Worth, Texas



Remove the side electrode from a spark plug then solder the plug to a crocodile clip and you have a simple ignition tester which can be clipped to a convenient ground on the engine. Attach the ignition lead to the tester then spin the engine over by hand with the plug removed from the head. There should be a crisp blue spark with a snap to it. If the spark is able to jump that large gap then all is okay with the ignition circuit and the plug must be at fault.

Jimmy Scurto Sr., Syracuse, Nebraska

Due to the noise at some fields it can be difficult to hear the "tune" of an engine. This contributor sets his needle somewhere quiet then places washers behind the needle as shown. After starting the engine with a rich setting he screws the needle in until it stops against the washer—the result being the same needle setting each flight.

Jennings B. Holt Jr., Loretto, Tennessee

The Golden Age of R/C

by HAL "PAPPY" deBOLT

I'VE HAD SOME GREAT responses from you readers lately. It seems that many have had similar experiences and would not trade them for anything. Most of the modelers I hear from are still enjoying R/C more than ever!

Walter Staff of Salt Lake City, Utah, is one of many old timers. He built a Super Buccaneer for free flight in 1936. He later switched it to R/C with a home-built single-channel and got himself hooked! In 1940 he flew a Bay Ridge Topper (a Gordon Murray design?) with R/C. He liked it so much that he is now building another and hopes to use electric power, which seems like an excellent way to duplicate early flight.

Walt remembers a discussion at the '63 Nats with Jack Butler (now a Pitts aerobatic pilot) and myself. In those days we were trying to determine which "mode" transmitter was best, Mode I or II, or single-stick. Twenty-three years later there still doesn't seem to be a clear-cut answer!

A letter from fellow columnist Randy Randolph of Dallas, Texas, brings a photo of a Miller receiver he built 35 years ago from plans featured in *M.A.N.* For kicks he recently fired it up and it still works. He remembers that locating needed components was a frustrating chore, especially the OSR quench coil needed for the Miller.

A popular feature of modeling magazines in those days was construction articles for R/C equipment. R/Cers looked forward to this info for the help and guidance needed to build their own radio equipment.

Dominic Costello of New Rochelle, New York, and the Bronx Blue Angels R/C club checked in with a photo of his Live Wire Senior built in 1956. There were only 250 Senior kits produced, so Dominic has one of the few.

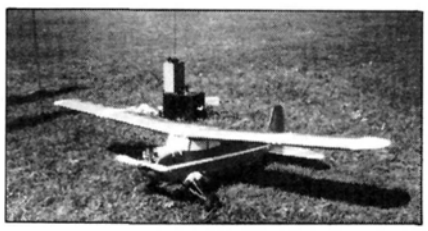
Dominic's first R/C plane was a Live Wire Trainer powered by an Ohlsson .19 and used an English E.D. radio. In 1952 a .19 was considered a bit much for a Trainer, which normally used a .09. On its second flight it flew away, never to be found. Unfortunately, this wasn't a rare occurence if the engine run wasn't limited. Dominic, however, managed 35 consecutive flights with his Senior, a local club record at that time.

Walter Staff sent this photo showing his homemade single-channel radio installed in a Bayridge Topper, circa 1946.

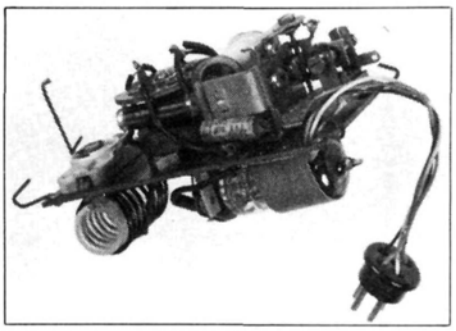
Dominic is still an avid R/Cer, enjoying giant-scale and the big gas engines with his club of 150 members. He also is one of the many OT R/Cers I've heard from who's still enjoying R/C.

I should break into the continuing discourse on radio development to discuss another important factor pertaining to R/C: the engines.

We take our modern powerhouses so much for granted that it's hard to believe engines had to progress simultaneously with radios. In the postwar era most popular engines were American-made; the USA lead the world in this respect. They were all developed for free flight and control line, both of which had little need for precise speed control. It's true that the pre-war engines were ignition, which did allow some amount of speed control and shutoff, but when the "R/C explosion" occurred, glow engines were the thing.

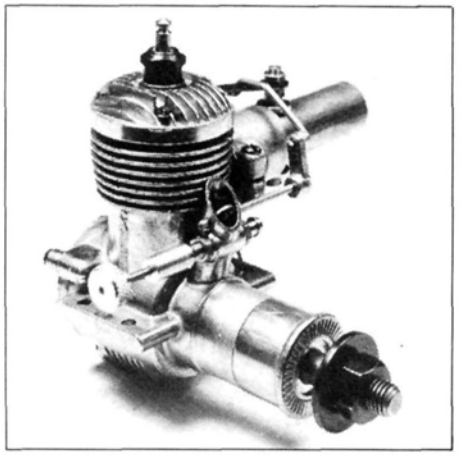


Randy Randolph provided this photo of his M.A.N. Miller single-channel receiver.



Dominic Costello's Live Wire Senior, 1956-vintage, used K&B .35 with Mac 2 transmitter and Lorenz receiver.

Popular glow engine brands were Ohlsson, K&B, Herkimer, Veco, Johnson, McCoy, and Fox. The need for speed control on R/C models presented a formidable problem for glow ignition.



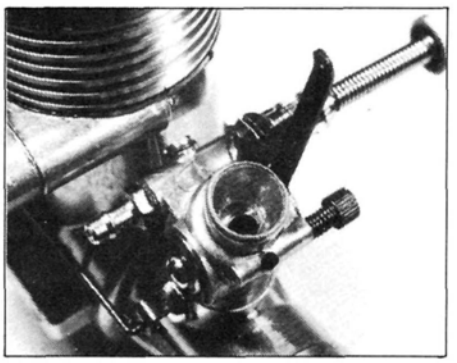
One of the first production R/C engines, Cameron .19. Peter Chinn photo.

As with radios, several avenues of development were followed before the current carburetor evolved.

The first effort was to add a movable baffle plate to the air intake, *a la* a stove pipe damper. It was very simple but also very unreliable. As the baffle reduced the air intake, the pre-adjusted needle-valve fed too much fuel for the slower speed. This richened mixture was so bad that the engine would barely run at slower speeds. It was apparent that any sort of reliable throttle would have to control *both* air and fuel intake. And that is what *all* carburetor development has been about ever since!

One ingenious thinker decided to attack the problem from the *other* end. He installed the baffle in the exhaust stack. The first concept was simple; a baffle fashioned from a common taper pin was inserted into a reamed hole in the exhaust stack. Rotating the pin-baffle controlled the size of the exhaust outlet. The smaller outlet reduced the mixture flow from the inlet onward, so there wasn't such a drastic mixture change as the engine slowed down. This action also held the heat in the engine at lower speeds, keeping the glowplug lit longer as the mixture richened. This was definitely a better speed control than the inlet baffle. We sometimes see a similar action today when an engine will not idle as low without a muffler as it will with one.

A few manufacturers combined the two baffle styles to offer the first store-bought R/C engines. You had to modify other engines yourself.



Early O.S. carburetor had fuel intake with the rear needle-valve. Front screw provided adjustable airbleed. Chinn photo.

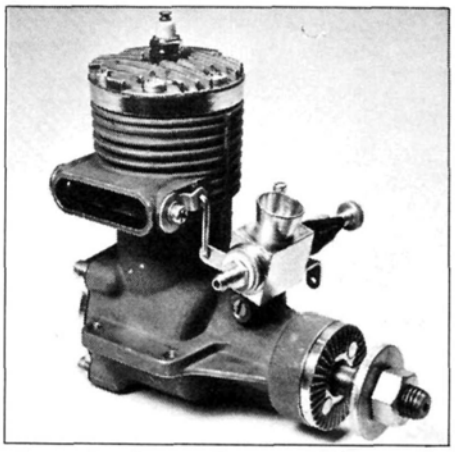
Answers to problems often come from unexpected places. I liked the F.F. Mills .08 diesel engine for small single-channel planes and admired its unique F.F. "shut-off" device, even though I had little use for it. If I slowly closed this device, the engine would slow down proportionately. It had to be fully closed to stop the engine. When the time came to think seriously about speed control, I remembered the Mills device.

At the time I was using .35 engines for power, so I turned on the lathe and fashioned a larger version of the Mills device to suit the engine. This device looked a lot like a simple modern-day carburetor, in that a housing is inserted into the engine air intake. In the housing was a barrel valve into which was inserted the needle-valve assembly. The device worked reasonably well and for the first time I had a decent glow engine throttle!

I was involved with the initial Bramco radio systems at the time, so I passed the idea on to them. Shortly thereafter, the Bramco Throttle appeared on the market and every R/Cer had to have one of those!

From then on, it has been a simple matter of the development of that original design. Actually, the concept of two circular valve openings and closings controlled both fuel and air intake reasonably well; all that was needed was a bit of fine-tuning, so to speak.

My contribution to fine-tuning was the addition of an air bleed, which tended to lean the mixture when the valve was in low-speed position; a distinct improvement.



An engine that set the pace for larger R/C model capabilities was the great Veco .45. Chinn photo.

The major manufacturers were quick to evaluate the various styles of throttles. Initial offerings combined an exhaust valve with the barrel valve throttle. Most added the air bleed feature also. These provided excellent speed control when properly set up and maintained.

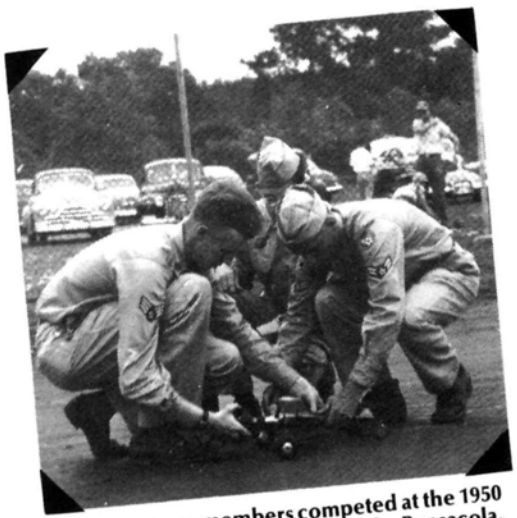
The next step toward today's carburetors came from Hi Johnson. His barrel-style throttle added a feature which moved the barrel sideways as it rotated. With this concept, the needle-valve was inserted into the moving barrel and the separate valve seat was screwed into the housing. It did not move. In operation, as the barrel valve closed it moved closer to the valve seat, inserting the needle-valve farther. With a long taper on the needle-valve the fuel intake was neatly controlled. For the first time we had a

(Continued on page 88)

Model Airplane News Photo Album

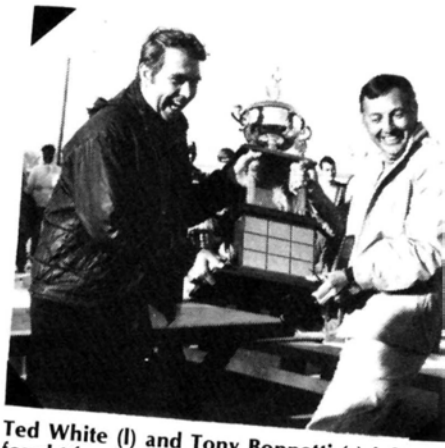
L.A. Hoffman of Downey, California, took this shot of the Downey Modeler's Club in the late '40s. All models are U-Control with ignition engines.

The legendary Sal Taibi gets an assist from wife Nan as she lights the thermalizer fuse.



Air Force team members competed at the 1950 Dixie Regional Model Airshow in Pensacola, Florida. Left to right: Sgt. Bryant Thompson, Sgt. Robert Young, and Cpl. Franklin Shaw.

The famous Paul Mantz was a strong supporter of modeling.



Ted White (l) and Tony Bonnetti (r) jokingly fought for the Winternats Perpetual Trophy.

PFC Thomas Kiester of Ft. Meade, Maryland, tries to convince young Terry Copeland that just because he found the airplane, he can't keep it.

Free-flight processing at the Nats. Always a pleasure.

Craft-Air REARWIN SPEEDSTER

Venerable Golden-Age flyer.

Model aircraft are different beasts to different people. Some of us fly the silent, almost ghostly soar planes. Many are captivated by the apparently limitless grace and power of a modern pattern ship. To me, scale is the place our hobby comes alive. These tiny replicas bring an echo of the excitement and bursting creativity of a romantic era long ago.

Feeling this way, it didn't take me long to get my hands on this new Craft-Air* release. The Rearwin Speedster is the second in the Master Craft series and like its predecessor, the RV-4, it offers terriffic value in a .40- to .60-sized package. Now before I get too far let me explain the basics of this kit. In no way is this intended to be an "every rib and rivet replica" of a classic subject. This is stand-off scale the way it was meant to be. It has the outline but not the headaches of the Toledo winner approach. The wing is a symmetrical airfoil built the old fashioned way; a D-tube design internally braced with plywood joiners. The fuselage is a sturdy ply box built up with stringers that add a realistic fabric-over-tube effect.

The recommended engine range is .35 to .40 two-stroke or .46 to .65 four-stroke. I went with my trusty .60 four-stroke mounted inverted. For the record, no unusual starting or running problems were encountered.

CONSTRUCTION. Although this is a scale subject, construction and design techniques are fairly conventional. Any builder with experience with a few sport planes should have no trouble building this model. However, don't make the mistake of thinking that this bird will go together after a few shakes of the box. It demands careful work and patience. Since most people building this plane will know what they're doing I'll skip the "glue part A to part B" routine. Let me concentrate on some notes that might help you out.

As I've said, the wing is an all-balsa D-tube with plywood joiners. The ribs are aligned with the leading and trailing edges using a system of lines drawn on the pieces to ensure a warp-free wing. The tips are built from several smaller blocks. They must be carefully sanded to create the correct shape. The most unique area is where the wing halves join. Instead of relying on a fiberglass cuff to hold the whole mess together, plywood braces are glued to the reinforced spars. This system is very strong and lightweight. Don't forget to install the small blocks that anchor the struts.

The fuselage is based upon an extremely rigid plywood box. Stringers and blocks build up the external shape of the fuse. This system allows for quick construction while retaining an authentic apperance. The cowl is built up from balsa blocks. A stocking was pulled over the shaped and sanded cowl. A couple of coats of thinned epoxy were then brushed over the stocking. This treatment resulted in an extremely strong and dent-proof cowl. Balsa fairings over aluminum legs shape the landing gear. This was also reinforced with light fiberglass cloth and epoxy.

The tail feathers are conventional ¼-inch sheets. I added "stringers" built from 1/16-

(Continued on page 78)

by STEVE SCOTTO

SPECIFICATIONS: ***Wingspan:*** *60 inches* ***Weight:*** *6 pounds, 4 ounces.*
Wing Area: *590 square inches* ***Engine:*** *See text*

color photos by LOUIS DEFRANCESCO, JR.

Rearwin Speedster Model 6000

by GENE THOMAS

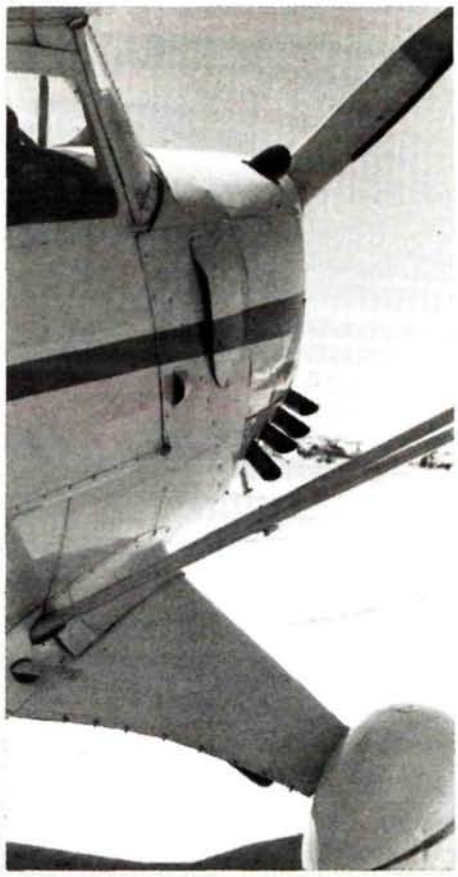
The second and final (only two were built) Rearwin Speedster was photographed by Gene Thomas in 1966 in Attumwa, Iowa.

THE REARWIN Speedster is a beautiful airplane and it's one of my favorites. This model (6000) is probably the most modeled of all the Rearwins if only because of its long nose moment which is ideal for rubber-powered aircraft. it's also easy to model because of its simple cowl (no cylinders to render). Ah, the simplicity of old airplanes. The Rearwin speedster was kitted by a number of kit manufacturers over the years and it flew as well as it looked.

In order to provide some sort of documentation, *M.A.N.* asked me to search my files. Knowing that I had photographed a Speedster years ago, I was fortunate to find it in a file at least 20 years old! I also went to my aviation bible, *U.S. Civil Aircraft.*

Much to my surprise only two Speedsters were built. I was fortunate enough to photograph one of them (N20741) at Attumwa, Iowa, in 1966 and I discovered that the paint scheme for the kit was wrong. After calling Lou Nelli at Craft-Air, I discovered that the aircraft he depicted as NC 19410 is yet another abstract. The only two aircraft built were shown (factory photographs) as X12588 (red with a silver stripe and a thin black pin stripe surrounding the silver). This, no doubt, was the original Serial Number 301.

It's impossible to tell what color the stripe is—it may have been red and, again, the pin stripe was probably black.



Since Craft-Air's model is sport scale, you can only hope that the three-views used were good. As an aero-historian, I'm often puzzled by the change in aircraft registration numbers because I only model original (factory) aircraft. And then I'm not really sure what I've done. I make a lot of telephone calls hoping to reach the people involved, but even they forget!

Nonetheless, the Rearwin Speedster is a beautiful airplane, aside from my discovering the dicrepancy in aircraft registration numbers. My photographs depict the airplane as it was flown years later.

Let me give you some specifics on the airplane:

Manufactured: 9/28/37
Power: A.T.C. Cirrus-Hi-Drive engine at 95 hp
Overall Length: 22′, 2″
Overall Height: 6′, 10″
Wingspan: 32′, 2″
Wing Cord: 60″
Wing Area: 145 square feet
Airfoil: NACA 2412
Empty Weight: 1,067 pounds
Useful Load: 633 pounds
Fuel: 34 gallons
Baggage: 50 pounds
Gross Weight: 1,700 pounds
Passengers: Two tandem
Maximum Speed: 144 mph at 800 feet
Crusing Speed: 122 mph at 800 feet
Rate of Climb: 750 feet per minute
Price: $3,295

(Continued on page 79)

NORTH AMERICAN B-25

From Royal Products

by CHRIS CHIANELLI

Considering the wide spectrum of roles and multiplicity of theatres and Allied countries with which it served, the North American B-25 Mitchell must be viewed as one of the most, if not *the* most, versatile aircraft that graced the skies during WW II, Allied or otherwise. This alone is reason enough to build your own flying shrine to pay tribute to the brave men who flew and died in the B-25. There is, however, an additional reason for building a B-25. If happens to be a kit from Royal Products*, the reason is simply that it flies so well.

I'm sorry, but I've been subjected to all the pontification I can stand on how "twins are a big pain in the butt," or "as soon as you loose an engine you've bought the farm." Well, fellow R/C squirrels, the Royal B-25 you see here is 5½ seasons old. The original configuration was done by Brooklyn's own king of the Sport Fliers, Joe Sylvester. It's true that with some twins, if you loose an engine, you're in deep "you know what." With this design, if you loose an engine and are not in position to land, the model, like its full-scale counterpart, is very managable. You can correct it with opposite rudder, or should I say rudders, keeping the turns shallow and never "goosing" the throttle.

An even better idea is to not lose an engine. That's why, along with the new paint scheme, I installed a new pair of O.S. FSR .45 ABC engines from Great Planes Model Distributors*. They replaced the discontinued but very reliable non-Schnuerled O.S. .40s.

O.S.'s reputation for out-of-the-box reliability has been proven to me over and over again; in this respect they're hard to beat. Using Rev-Up 11x6 props I'd tach the engines conservatively at 10,200 to 10,600 rpm on the ground figuring for a 500 to 1,000 rpm gain in the air. Sure, these powerful engines could turn within the 12,000 to 12,500 rpm range with theses props but the rich setting gives a good safety margin and still pulls the model at hair-raising speeds.

I also recommend keeping the plugs fresh. You can always use a dubious plug in one of your single engine models. Also use a flight timer so you don't run one engine out of fuel because you're so caught up in interdiction

The Royal B-25 has the accurate scale lines of the Mitchell. Only the heads of the O.S. 45s protrude. Panel lines and markings add to the scale effect.

SPECIFICATIONS
Wingspan: 70⅞ inches
Wing Area: 750 square inches
Engine: .40-.45 two-stroke
.46-.60 four-stroke
Weight: See text

or skip bombing raids. I used J'TEC* JT405 In-Cowl Universal mufflers. This particular series of J'TEC mufflers gives you the option of using a mounting strap or, even better, shows you how to drill two holes so you can use the two screws that normally hold the stock muffler.

This is obviously not a construction article, but let me say, the B-25, having basically a box-type fuselage, isn't that difficult to build. To further simplify things you can cover your B-25 with Coverite's* aluminum micafilm and panel line it or use a seamstress' marker to simulate rivets as I'm doing on my latest project, Royal's C-47. I covered the B-25 with silk-spun Coverite and painted it with Formula U. The panel lines were done with an extra-fine point Sharpie Permananent Marker. I gave the whole model a coat of Black Baron flat clear after all final markings and decals were put on. This stuff works great and gives the glossiest of finishes and that realistic military matt look. Incidentally, my scheme is a North African theatre camouflage that flew over Tunisia. Note the yellow boarder around the insignia. For you sticklers out there notice that where my plane is tan, it really should be a lighter desert "pink". The scheme before this was all olive drab and the lighter tan was going to require too many coats to cover the dark olive, hense adding more weight. My solution was to go to a darker tan.

And now for the fun: flying! The day of the flight test was picture perfect; 70° degress, low humidity, and a 5 mph breeze. I was a bit nervous for two reasons. I only had time to run one tank of fuel through the engines. I strongly recommend much more break-in time, but I simply had my back up against a deadline. As it turned out, the O.S. engines performed flawlessly throughout all the testing which certainly attests to their dependability.

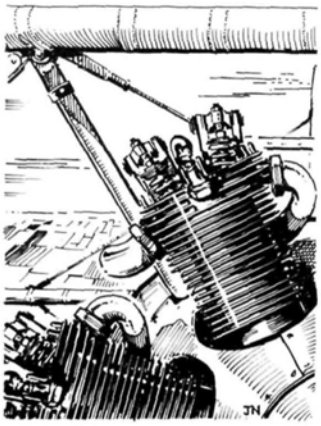
The other worry was weight. The model was originally slightly above 10½ pounds. After its third paint job it was over 12 pounds. After many re-checks I said, "I guess it's time to fly." With that, Louis DeFrancesco barked, "That's right, time to fly!" The O.S. engine, once again, started with a few flips. I ran them up to do a final synchronization. The droning of the two engines, beating in and out of sync, even made Louis's demanding voice seem puny.

I throttled back, checked the idle, and gave the sign to let her go. The B-25 taxiied very straight down the taxiway. Rhom-Air's* steering system felt very positive. When I got to the end of the runway the model did a beautiful 180° about-face into the wind. I went to full throttle and both engines came up pretty much together. As the rollout increased I kept her on the ground until the end of the runway was near; the runway where I fly is short. The Mitchell lifted off and banked to the right. I corrected with left aileron trim and brought up the Rhom-Air retracts. The model also needed a good bit of up trim, but after these two trim adjustments, she settled in nicely.

I brought her upstairs to check slow flight characteristics. In spite of the increased weight the model still retained very forgiving stall characteristics. I was now ready for some low

(Continued on page 81)

photos by LOUIS DEFRANCESCO, JR.



Four-Cycle Forum

by ELOY MAREZ

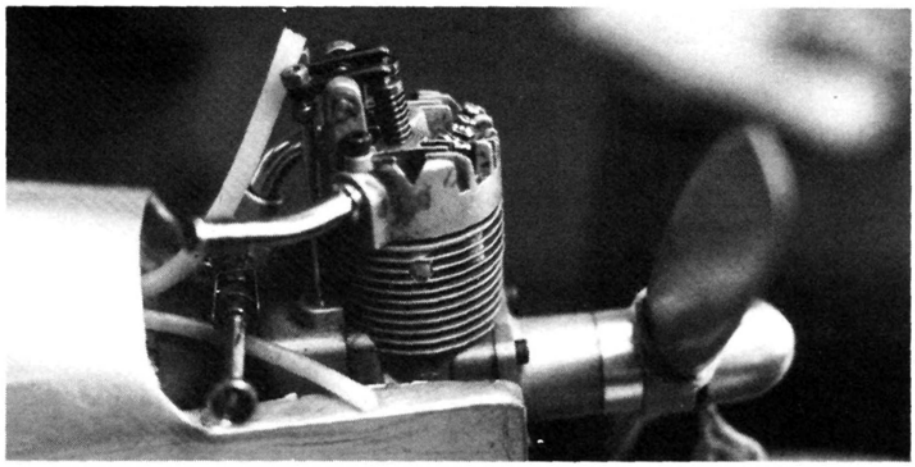
Problems with parts is the subject of a letter from Dick Wolsey of Reading, Massachusetts, who writes:

"In the April issue of *Model Airplane News,* there was a letter from Ron Gamelli of Feeding Hills, Massachusetts, of the Pioneer Valley Club. He was evidently having some trouble with his four-strokes losing power after a certain length of time, and I myself have had the same problem. I'll try to explain what's been happening to me.

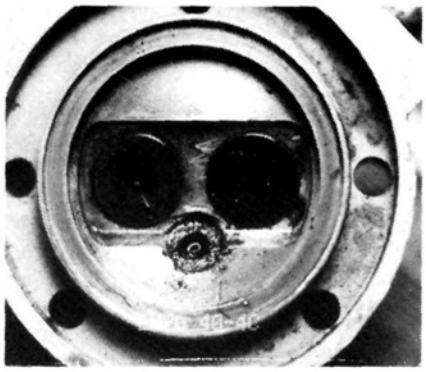
"I've included a photo of my Enya .40 four-stroke. I've run it continuously now for four years, and I think it's in fairly decent shape. I've been good to it; no crashes and I don't run it lean. I did, however, put some fuel through it that was contaminated and it has caused me untold grief. The next photo is just an overall photo of the interior of the cylinder head showing the valves. The one on the right is, of course, the exhaust valve, which you can see is dirty and burned. The one on the left is the intake valve. Next is a photo of the exhaust valve. You can see how dirty it is, particularly at the bottom of the stem by the trumpet. This just scrapes off, and is from fuel contamination.

"The problem some of us are experiencing is something that might not be too easily remedied. In the photo of the head, the exhaust valve is on the right, the intake on the left, and the valves are removed. At the valve seat in the exhaust you can see areas of black. The next photo shows the same condition. These black spots are where the valve seat in the head doesn't fit. The valve, when it seats, doesn't hit in this area and there is leakage by here. That's why they are stained black with the exhaust residue, just like the valve is stained.

"After close examination with a 10X scope on the valve seat itself, it appears that the brass insert in the black areas shows a honeycombing or erosion of the metal. Very careful lapping will get rid of this. In some instances though, it was fairly deep.



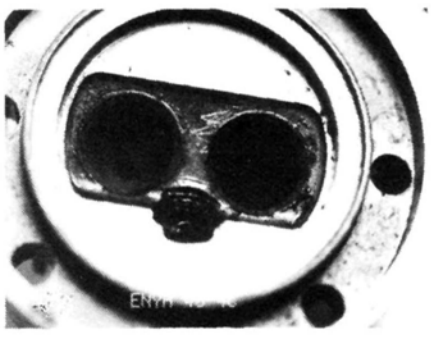
Four-cycle engines require some attention, as learned by the owner of this engine, Ron Gamelli.



Left is intake valve, right is exhaust. Note buildup of deposits.

"I have an Enya .46 where this kind of erosion almost made the head useless. I'm trying to hand-lap and it's difficult if it goes too far. I think the problem that Ron and I are having is brass erosion due to nitro in the fuel.

"Maybe someone has the answer. What I find is that the valves aren't seating right and you can see exactly where because of the black residue on the seat. Upon close examination you see that it's an erosion of the seat. I don't believe it's from foreign matter hitting the soft brass insert, but just an erosion of the metal."



Valves removed from head show black spots where the valve is not seating properly.

Last month I talked about the effect of nitro on engine components. I'm sure that nitric acid isn't discriminatory and

will attack brass or one of its alloys just as it will ball bearings.

For this reason, one of the after-run oils is definitely recommended. I've also heard that a liberal dose of WD-40 can be applied, after which the glowplug

Valve of Enya 40-4C shows buildup on stem, especially on the bottom near the trumpet.

battery is connected and the engine turned over with an electric starter. The carriers in the WD-40 will ignite and burn, taking any unwanted fuel residues with them, but leaving the lubricants, which is what we're looking for in the first place. I haven't tried it, but if you have let me know the results.

The subject of valve grinding is one that I'm reluctant to touch. Properly done, it's bound to benefit any engine that is suffering from leaking valves. I don't mean valves that leak only when you turn the engine slowly by hand because, as mentioned earlier, there's more spring force applied while the engine is running and the time that the valve has to maintain a seal is much shorter under running conditions. But, if the engine has started to lose power and everything else is normal, then it's time to take a 10X look at the valves and consider some grinding. Unfortunately, this is one of those subjects for which every other engine man you talk to has a different process, and he will swear his is the only one that will work. My first recommendation is that if you're not reasonably mechanical and extremely patient, you should not attempt it.

Looking at Dick's second photo, you can see a slot in the end of the valve, similar to a screwdriver slot, but shallower and thicker. This is the valve drive slot into which a tool is inserted during the grinding process. If this is done at the factory, it's probably done with automated machinery. You'll have to improvise. The recommended motion is not a rotary one that you can do with a drill or Dremel tool; it's a back-and-forth motion which apparently results in even metal removal all around.

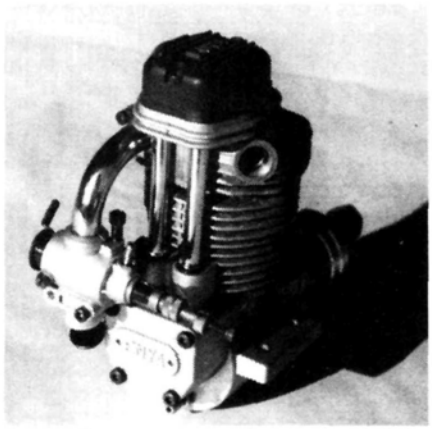
Valve seat upon examination reveals extensive errosion.

For automotive engine valve grinding, you can purchase a hand tool that looks slightly like a hand drill, but which doesn't turn the work bit continuously. It works in the recommended back-and-forth motion. It's possible that one could be adapted with the proper mating bit to accept the smaller model engine valves. Obviously, the first step is to see that your engine valves do in fact have that slot in the head; not all of them do.

The next important choice to make is the selection of the grinding compound which is made in all grades from "Rocky Mountain" on down. Start with a medium grade, work down to fine, and end up with a polishing grade. Take your time, cleaning and inspecting your work frequently as you go to be sure that you aren't taking off more than necessary. Be extremely certain that every bit of the compound is removed from all parts when you are through. And please report your procedures and results to me so that I can share them.

O.S. Carburetor

All modelers are great experimenters and four-stroke fliers are no different. Some of you have found that the performance of some of the Enya engines can be improved by the addition of an O.S. carburetor, and I've mentioned that subject here before. It might be that it's simply a matter of more experience with one particular type of carburetor, but here is the result of one reader's conversion. Bud Wolfe of Scottsdale, Arizona, writes:



O.S. carburetor mounted to Enya 1.20. See text for details.

"Enclosed are a few photos of my early model Enya 1.2 with an O.S. 1.2 carb installed. I opted for the O.S. carb

(Continued on page 82)

Radio Control New

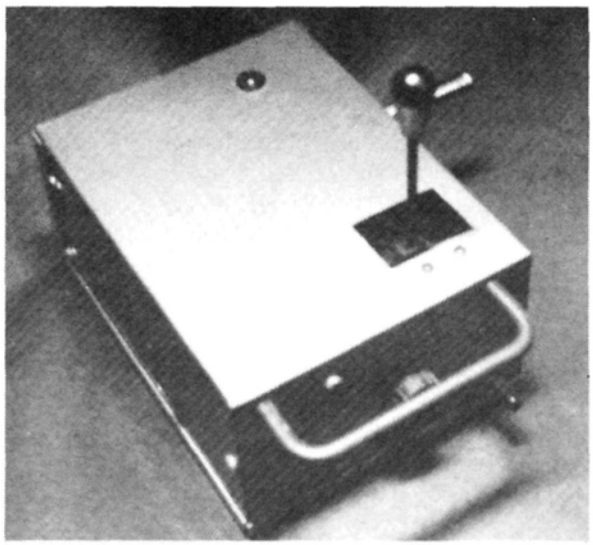
by ART SCHROEDER

IN THE JANUARY issue, part of this column was devoted to radio equipment longevity. I was motivated by my aging Kraft Signature Single-Stick system, its "Chidgey" control stick, and the fact I cling to it after 10 years of flawless service. I further stated that I hoped a manufacturer would pick up the Chidgey stick as a system feature.

Well, the few paragraphs seemed innocent enough but they sure raised my level of mail. There were many questions and comments relating to single-stick: "Why do you like the style?" and "There are a number of styles already available—not just the Chidgey version." I am, frankly, surprised at the interest. Perhaps there are some more modelers thinking about single-stick than I thought but, they simply don't see enough of them to get any idea about how they work or why they even exist.

So let's look into this in a bit more depth. To understand why I like single-stick, you must realize that that was the way I started in R/C. Back in the early '50s, northeastern modelers—particularly Howard McEntee—were engaged in experiments with pulse proportional that included magnetic actuators by Adams, Mightly Midget actuators, electronic and mechanical pulsers, Kickin' Duck, Galloping Ghost, and TTPW. Along with McEntee were folks like Walt Good, Ray Ketchledge, John Worth—the list of experimenters is long and honored. It isn't, however, my intent to add to Hal deBolt's fine new column, "The Golden Age of R/C," appearing elsewhere in this magazine.

Rather, the important thing to this discussion is the fact that all those early pulsers (the thing we actually held in our hands) were usually single-stick controllers. The sticks were primitive with very wide neutrals. (At times it seemed about half of any given surface throw!) But they put the aircraft primary controls on one stick to vary and mix the positions of available controls as in full-scale. Of course, for most of us, this stuff was homemade and design (and success) varied all over the lot. In fact, a high percentage of my efforts in those days were "all over the lot" more than once.



Original Airborne Control Lab single-stick transmitter for REM (rudder, elevator, motor). This was an analog system and one of the most reliable early proportional transmitters.

Anyway, these proportional efforts were followed by more or less successful commercial developments in such systems as Space Control, Sampey, Dee Bee, ACL, and Orbit. These were all single-stick types and I had them all. At the same time, reed systems were also being developed with their multiple switches for non-proportional control and, because of high reliability, reeds became the dominant radio type for several years.

Even so, many of us continued with our less-than-perfectly-reliable single-stick proportionals. My first truly reliable (one that would work with no fuss, week after week) proportional system was manufactured by Airborne Control Labs (ACL) and this was followed by an Orbit Proportional (a true classic in my opinion). After so many years invested in various kinds of single-stick, it became impossible for me to change. Single-stick was my "natural" way to fly and I tout the style for all simply because it's a way to mix all controls with your dominant hand; in my case the right one. All primary controls are held by that one hand. To me that is natural since my left hand has never been useful to the fine degree good R/C flying requires—I simply never trained myself to use it!

As proportional reliability increased, many long-time reed fliers began to accept this "wave of the future." But these fliers had been commanding their aircraft with both hands. Virtually all reed transmitters had the aileron switch on the right side and elevator on the left. I must confess that I tried reeds once and I crashed a lot. I tried a second time with Bramco equipment that had a reed control box that was sort of single-stick and I crashed a lot more. So, it was back to propo (I crashed a lot with that too, but that's not part of this story).

For long-time reed fliers, the balanced use of right and left hands was accommodated by the introduction of two-stick proportional transmitters in what we call today, Mode I (elevator left stick, aileron right stick). That's right, two-stick came well after single-stick (and not as an improvement but rather as an accommo-

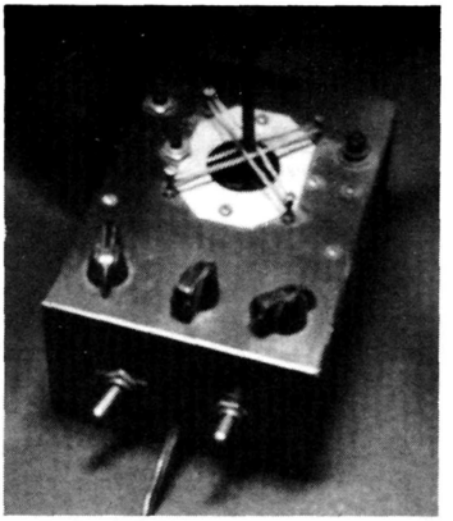
dation). Moreover, Mode I is so called because this was the first thought toward those who had been flying reeds. And, because reed fliers were in such a majority in the late '50s and early '60s, two-stick became the most used proportional type as it remains today.

Interestingly, Mode I did not remain the top flying style. That "honor" fell to Mode II where, as most know, aileron and elevator are coupled on the right. This fascinates me since Mode II is at least 2/3 single-stick and the limited rudder work I see with Mode II by many fliers *is single-stick!* It is, by the way, the ease of introducing regular rudder inputs into single-stick flying that is one of its biggest advantages.

Airtronics Championship single-stick series. Utilizes closed plastic gimbal. Features reverse channel and mixing.

I don't expect to convince many that this is a great way to fly, but it at least outlines *my* reasons for using single-stick. By the way, and for those who asked, I won't sell my Kraft Signature single-stick for anything. At least not until I can replace it with an equivalent.

I did at least imply in the earlier article that the Chidgey stick was the only stick.



Very early single-stick controller, Ketchledge pulser. Unit plugged into ground-based MAC II transmitter. Provided rudder, elevator, and motor control.

That, of course, is not so. There are other single-stick arrangements that perform very nicely and include Airtronics, JR, Ace, and Futaba—all have developed smooth, effective single-sticks. Another manufacturer I should have mentioned was Millcott and their Specialist system. I've flown with the radio courtesy of Duke Hoeckele and it's the equal of the Chidgey stick. John Elliot of Cox Hobbies reminded me. John, in part, said, "I read your column in the January issue with relish as usual and felt I had to comment. Old 'Thingle-Thick' fliers never die, Art!

"If you have never sampled the Millcott Specialist single-stick transmitter gimbal, you're missing out. Chronologically, good all-metal open gimbals are: Proline (Chidgey), S&O (Salkalsky and Oddino), Orbit (Dunham and still used in the in the Ace Silver Silver Seven), and Millcott (a refined Orbit gimbal with lab-quality pots). The Orbit (now Ace) and Millcott designs are such that they can be set up and adjusted before installation. They aren't dependent on transmitter can for mechanical rigidity as was the Proline/Kraft gimbal. *(I'm not sure that John's order is correct since my Orbit preceeded my use of the Proline by several years—AFS).*

"Like you, I've had the opportunity to fly most radios and I still appreciate a good transmitter in my hands. Some of the better radios around today have single sticks with new technology plastic gimbals and they are pretty good, but, for my money, the older technology with metal gimbals is better."

If you decide to opt for single-stick, look for a no-slop quality around neutral whether it be made of molded parts or machined metal parts. It's only an absolute repeatability of neutral on all three axes that makes single-stick work in a way that will realize its inherent advantages.

And finally, my call for annual system checkups at the factory or a good service outlet is something I will continue to recommend. Electronic components age and change their characteristics; tuning shifts, wires fatigue, pots wear and get noisy, dirt and corrosion affect contacts and connections, vibration takes its toll, and batteries lose their capacity. All this can be corrected and adjusted by a careful technician. It takes a few weeks and some cash outlay, but the procedure is the cheapest insurance an R/C modeler can buy!

Art Schroeder, c/o *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897. ■

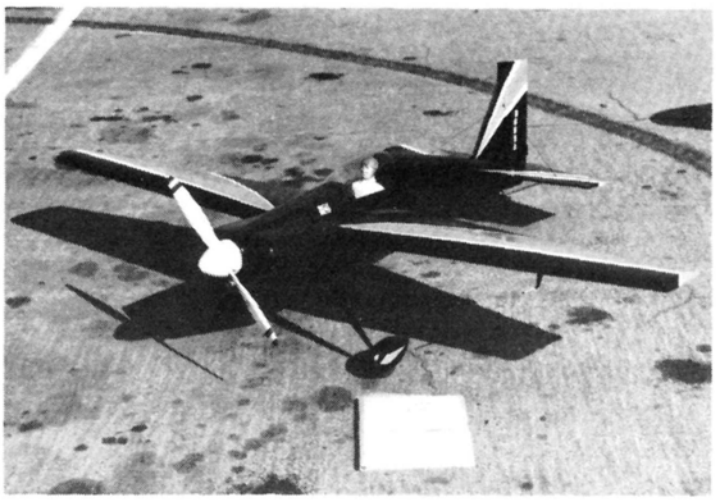
What's Up With Electrics

by BOB SLIFF

Paul Hingtgen with his winning Astro Viking Old Timer, a very fine pilot and model.

THE 12TH ANNUAL Astro Flight All Electric Championships was held this year on April 26. E-power competition activities have been around for some time now. I should know—I attended the first ever, held at Sepulveda Basin Recreation Park in Los Angeles, California. It was then that I became inspired to dip into the E-power barrel. I've had fun and success ever since and I've learned a great deal along the way. (I've also learned that there's still a lot more to learn and discover in E-power.)

Over the years I've seen a number of very important advances, both in models and in power systems. One was the development of cobalt motors with their ability to handle high currents (70 amps for the largest and 25 amps for the smaller 7-cell sizes) with the resulting high horsepower and fantastic speed and climb in our models. They were first developed in Germany and soon after by Astro Flight* in the U.S. In addition, it was discovered that the Sanyo nickel-cadmium cells, especially the "cutoff" variety, can supply tremendous power to our motors and do it with greater reliability than most other brands. Models also have come of age with the appearance of a large number of designs in the modeling press, as well as the appearance of several companies producing kits specifically for E-power.



Bill Young's winning scale entry, a Stephen's Akro. Tube under prop is for smoke ejection.

This year's affair covered three days, one for free flight and U-Control, and two for R/C. Since I was unable to attend the FF and UC events, I'll only offer my comments on the R/C aspects.

On Saturday April 26, the Sailplane and Old Timer events were offered at the Fairview Regional Park in Costa Mesa, California. These events were hosted by the Harbor Soaring Society (it is their official club flying site), with several of the club members assisting in running the contest as well as flying in the events. They all did a great job making for a really fine time.

As advertised, there were two types of Sailplane and two types of Old Timer. They had originally hoped to run three rounds of each, but eventually it stopped at two (a third round would have extended flying nearly to dark). In typical California fashion, the weather was beautiful, with thermals breaking off regularly. If there was any problem for the contestants, it was most likely a sunburn.

The contest got under way at 9:00 a.m. with the first round of 7-cell Sailplane. Launching was done in heats (usually four contestants) with all fliers launching at the same time.

After the launch master shouted "launch," he timed the motor run, and shouted "off," at which time each flier's timer would start his watch for the 7-minute glide period. At the end of 7 minutes (if the fliers could make the full time), there was a rush for the designated landing

area to try to touch down exactly at 7 minutes for full points. An additional 10 points were given for landing in the landing zone. (Scoring was "man-on-man" so you only had to rush for the landing zone at 7 minutes if more than one flier was going to make the full time.)

Each of the classes had their turn; 7-cell Sailplane, 7-cell Old Timer, Open Sailplane, and Open Old Timer. After the first round, the fliers' cards were reshuffled, and the second round began. All of this ended at about 3:00 p.m. The winners were announced, the trophies were awarded, and the donated prizes were awarded to the fliers in a raffle.

On Sunday, the events moved to Mile Square Park in Fountain Valley, California. Here Scale, Aerobatics, and 7-cell Pylon were offered. As on Saturday, the events followed each other in rounds, until two rounds were flown in each category. The activities ended around 1:00 p.m. with the awards and raffle.

Because I was officiating, most of my knowledge consists of impressions of some really interesting items. First, I was extremely impressed with the performance of some of the models. On Saturday, even with the motor run on 7-cell Sailplane reduced to 45 seconds, most every entry had the power to climb to an easy thermaling altitude. Ed DePue, the winner of this event, flew very well to capture first place. His Geared Challenger 05 design easily got him to thermaling altitude on both of his rounds. Over all, the best gliders in the category were powered by the Astro Challenger Cobalt 05 geared systems using folding props. The best props were the Geist and the Midway Folders. I found that prop blades made from the Yoshioka 11.5x10.2 prop (marketed by Global Hobby Distributors*) and using the Midway hub gave a very good climb; much steeper than other props that I've tried. (Blades, cut and drilled are available from Hobby Horn* for $9 a pair or $12 for the complete folding prop.)

Ed DePue holds winning 7-cell entry, an excellent flying model.

Another remarkable performer was the little Electragnome flown by John Lupperger. The 60-inch span Gnome was powered by an Astro Challenger 05 7-cell motor and it had the best climb of any of the gliders. In addition, Larry Jolly came with a new small glider, the Electramight, sporting one of Astro Flight's new 035 cobalt (5-cell) motors. The Electramight did remarkably well against the larger ships and climbed easily as well. (Look for a construction article on it soon.)

Coming all the way from Minnesota to win the Open Sailplane event, Craig Christianson did it with his LJMP Olympian.

Seven-cell Old Timer showed some really interesting models; Chuck Hollinger's Nomad (he's the original designer) really stood out for design, construction, and workmanship. The winner, however, was Paul Hingtgen, who did an excellent job with an Astro Viking.

In the Open high-power events, the Old Timers put on the most awesome displays of power. The first place winner, Mike Charles, flew a Super Quaker to "new heights," literally! Powered by an Astro Cobalt 60 and a direct-drive with a small Geist prop on thirty 800-mAh Sanyo cells, it just "blasted" up to altitude. Ross Thomas was second in the power race, and he did about the same with his Lanzo Bomber powered by a geared Astro 40 on twenty-six 800-mAh Sanyo cells and a small Geist prop.

Sunday's events went rather quickly because there were fewer entries. Impressive flights were put in by Steve Neu

(Continued on page 86)

Control Tower

by CHARLIE KENNEY

THIS MONTH I have another new radio to review: Polk's Modelcraft Hobbies* Aristocraft Hi-Tech Challenger 620 six-channel FM radio system. This radio is manufactured in Korea and has many features.

The transmitter has six channels with servo-reversing, dual rate on aileron and elevator, rudder/aileron and elevator/flap mixing, and adjustable length and tension on the control sticks. The receiver features a dual conversion front end for narrow band width performance. Servos are water-resistant and have high output torque.

The set arrives in an attractive box with a protective styrofoam container. The system, as received, consisted of transmitter, receiver, three servos, a switch harness with charging jack, receiver battery case, two servo trays, spare arms, and servo mounting hardware. All in all, it's quite a package for a little over $100.

The Challenger 620 requires alkaline dry cells; nine for the transmitter and four for the receiver. Polk's also offers a $30-plus add-on package which includes nickel-cadmium transmitter and receiver packs plus a charger and a fourth servo. Again, it's a very attractive price. Let's take a more detailed look at the features of the set.

Transmitter—Challenger 620

- Specially designed lightweight case for ease of operation.
- New, accurate, smooth-operating control sticks.
- Control stick length and tension adjustment.
- Adjustable throttle control stick travel.
- Easy access servo-reversing switches—all channels.
- Aileron and elevator dual rate.
- High-efficiency 10-section telescoping antenna.
- Elevator/flap mixing.
- Rudder/aileron mixing.

TRANSMITTER—CHALLENGER 620

Operating system: 2-stick system
Transmitting frequencies: 72 MHz (all) reviewed unit 72.670, Channel 44 yellow-yellow
Module change system: Precision module that permits frequency change within the same band (72 MHz)
Modulation system: FM (frequency modulation)
Power supply: 13.5V (9 alkaline batteries) or 10.8V (9 NiCd batteries) AA size
Current drain: 150 mA (13.5V)—130 mA (10.8V)
Dimensions: 7.5x6.5x2.5 inches
Weight: 2 pounds, 2 ounces

RECEIVER HP-6RM72F

Receiving frequency: 72 MHz (all)
Crystal change system: Precision crystal that permits frequency change within the same band (72 MHz)
Intermediate frequencies: 10.7 MHz and 455 kHz
Power supply: 6.0V (4 alkaline batteries) or 4.8V (4 NiCd batteries) AA size.
Current drain: 30 mA (quiesent)
Dimensions: 2.4x1.7x0.9 inches
Weight: 1.8 ounces.

SERVO HS-402

Control system: Positive pulse width control (1.55 ms neutral)
Operating angle: One side 45°
Power supply: 6.0V (4 alkaline batteries) or 4.8V (4 NiCd batteries) AA size.
Current drain: 8 mA at 6.0V (neutral)
Output torque: 42 oz-in.
Operating speed: 0.24 sec. 60°
Dimensions: 2.0x0.8x1.9 inches
Weight: 1.6 ounces

Rear of transmitter shows dual rate, mixing, and reversing controls.

- RF power output meter.
- Battery check button.
- Neck strap connector.
- Charger connector for optional nickel-cadmium batteries.
- Specially-designed battery case accepts alkaline or nickel-cadmium batteries.
- Quick change frequency module.
- Electronic trim adjustments.

Challenger 620 system—very economical and versatile.

Receiver—Challenger 620 HP-6RM72F

- Dual conversion.
- Narrow band width for 1991 standards.
- Dual gate field effect transistor RF amplifier.
- Squelch circuit.
- Voltage regulation.
- Locking type terminal connectors.

Servo HS-402

- Indirect drive for gear train protection.
- Water-resistant.
- High-impact case.

I like to start with the transmitter because it's the heart of the the radio system. The transmitter is constructed of aluminum and plastic. The brushed gold-colored aluminum and brown plastic makes a very attractive appearance. The transmitter is lightweight and easy to hold.

Let's take a look at the controls starting at the top left. This is the channel 5 switch and is normally used for landing gear; On is forward, Off is rear. Next to the channel 5 switch is the carrying handle and the 42-inch, 10-element telescoping antenna. On the upper slanted portion of the front panel are the special controls. From left to right is the channel 2, or elevator dual rate (D/R) switch; the forward position is On, back is Off. The D/R adjustment pot is located on the rear panel and will be covered later.

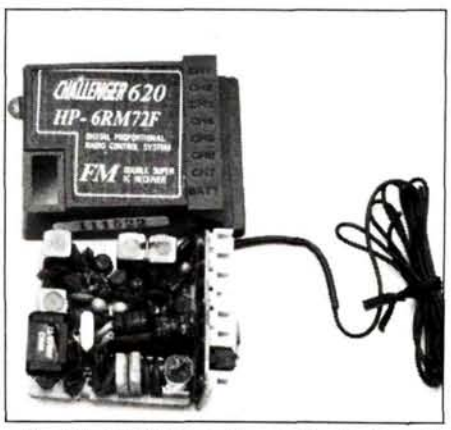
Moving right is the channel 6 Control Set for flaps. It's a 41-click ratchet pot. It can also be used with the elevator/flap mixer when the elevator/flap mixing switch is On. Moving right is the battery push-to-check button. When depressed, the lower power meter scale gives you a relative battery check. As long as the indicator is in the green, it's okay. If it's in the red, change batteries if you're using alkalines or recharge if you're using nickel-cadmium batteries.

The conversion package included NiCds, charger, and spare servo.

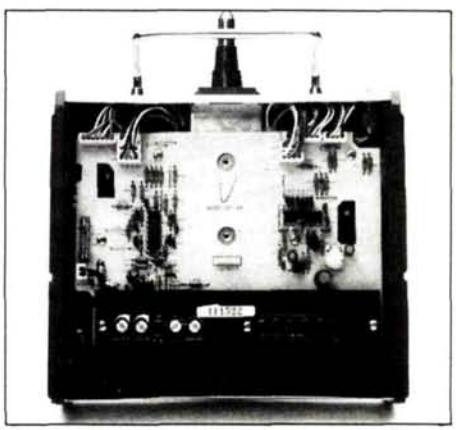
On the right side of the top there's another 41-click control called the elevator trim mixing knob. This sets the

(Continued on page 82)

Aristocraft offers a high-tech transmitter at low price.



The HP-6RM72F receiver is double tuned. Note two crystals.



Inside rear of transmitter reveals neat, state-of-the-art engineering.

Giant Steps

by DICK PHILLIPS

EVERY ONCE IN A WHILE something I mention triggers a reaction among my readers. I ran a photo a while back of a Lysander built by Len Bosman* of Vancouver, Canada. Shortly after that I ran a picture of Len's Boeing F4B-4. Both of these pictures got a great reaction from you and the F4B-4 resulted in a rash of mail asking if there was a plan available. Well there is.

As you can see from the picture, this is a good looking model and one which has excellent flying characteristics. The outlines are very close to true scale so it would be possible to build a competitive model from the plan.

I also received a plan from Wendell Hostetler*. Wendell is probably one of the most prolific designers of today and his work is well known.

His latest effort is a model from the '30s; the Gilmore Red Lion, one of Roscoe Turner's mounts at one time.

Wendell has a number of models out and he used to display them over his booth at the Toledo Show. There are now too many of them and he shares their excellence with Tom Keeling at the T&D Fiberglass Specialties* booth and with Bob Shattleroe* at his booth. Tom makes the fine cowls available for Wendell's models and Bob makes the custom landing gears. The three booths make a great showplace for the models and also show off the products available for their completion.

The Red Lion is a beauty and is typical of race planes from the '30s era which established many world records and set the trends for aircraft design for the years between the wars.

Reasons for Quarter Scale

I received a letter from David Poser* of Lodi, California, and he went into his rationale behind getting into Quarter Scale. Unfortunately the letter is too long to reproduce here. However, David makes a few good points in his letter. He suggests that there are too many people saying that large models are too expensive and counters with the fact that there are now some kits on the market for under $100. Engines costs about the same and that compares favorably with the cost of some glow-sized kits and glow engines. He also says that larger models are easier to fly. (And that's a fact!)

David has designed a model called the Blaser which is small enough to cart around in a small car. The Blaser uses a Zenoah G-23 and incorporates some builder modifications. Contact David if you want more information.

1985 Tulsa Glue Dobbers Jumbo Fly-In winners. From left to right: Bud Kincaid, Woody Frantz, Pat Jones, Ken Bina, and John Spurling.

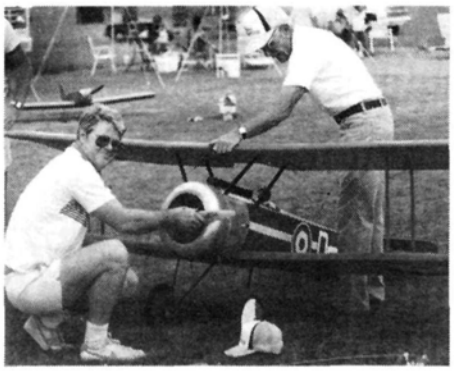
George Pringle sets his engine as Jim Roland holds. Over 90 giant airplanes attended the Glue Dobbers affair.

Dennis Reeves' Horner-powered Giant Stick being preflighted by an avid Giant-Scale fan.

AMA News

While there aren't many of you out there building *very* large models, you should be aware that the AMA recently voted to withhold sanctions (and therefore insurance coverage) from any event which allows models weighing over 55 pounds to fly. In addition, if a sanction is issued for an event at which such as model is flown, that sanction is automatically cancelled at the time of the overweight model's flight and for the remainder of the event.

Until the AMA Council accepted this recommendation unanimously last May,



Woody Frantz won Best Military Scale at Tulsa. Bud Kincaid holds as Woody prepares to fire up the big Pup.

there had existed an agreement between AMA and IMAA that such overweight models could be flown at sanctioned events. However, AMA legal and insurance advisors have both advised AMA that this puts AMA in a very vulnerable position. In the case of an accident involving the flight of such a model, and where injury results, the chances are that AMA, the sponsoring body, and almost everyone involved, would be sued for damages. Court judgements (and therefore insurance premiums) have skyrocketed in recent years and liability insurance is both hard to come by and very expensive. The decision seems to me to be a valid one and one which I suspect was inevitable.

Wendell Hostetler now has plans for the Gilmore Red Lion. See text.

FAI News

At a recent meeting in Paris, the FAI voted a weight limit of 20 kilograms (44 pounds) on competition models. The European authorities have been noticeably reluctant about our 55-pound limit and have chosen to go with this 44-pound limitation. It seems to be at odds with what has worked very successfully for us in North America for quite a number of years. It would be a great shame if AMA followed that rather short-sighted lead and opted for the 44-pound limit at some future date. I resent the "Big Brother" syndrome and suspect that large numbers of you agree with me. We already have all the regulation we need and Giant Scale has proven to be a very safe area of the hobby over the past ten years.

It's up to all of us to ensure that it remains safe and in doing so, we'll be able to avoid such policies. I know there are many of you who have objected in the past to rule changes forced upon us by the European community so let's hope we don't have any more of the same. I don't think we need it and I'm darn sure there are few of us who want it.

Next Month

In next month's column I'll cover some good stuff on landing gears; how to make them, how to set them up, and how to keep them operating properly. In the meantime, I'll do my best to answer your letters and questions.

If you have an interesting project in hand, or have been to a rally or fun-fly lately, let me have some of your black and white photos for possible use here.

Len Bosman's Boeing F4B-4 is also available in plans. A great flying airplane by the Canadian.

That's how we find out about all the neat stuff you guys are designing, building, and flying. Your letters are always welcome and I'll do my best to answer them all.

If you fly 1/5-, 1/4-, or 1/3-scale, you should be doing it with IMAA*. *High Flight,* IMAA's newsletter, is meant for the Giant-Scaler and it's chock full of good news, good products, and good advice. IMAA is also one of the best bargains around. At $12 per year, you won't find a better one.

Next month I'll also have coverage of the IMAA Festival which took place in Lansing, Michigan, in July. I hope you were able to make it, but if not, I'll have pictures and details next month.

Dick Phillips, c/o *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the companies and people mentioned in this article:*

Len Bosman, 193 Baltic St., Coquitlam, B.C., Canada V3K 5G9.

Wendell Hostetler, 1041 Heatherwood Ln., Orrville, Ohio 44667.

T&D Fiberglass Specialties, 30925 Block, Garden City, MI 48135.

Bob Shettleroe, c/o T&D Fiberglass Specialties.

David Poser, Laser Enterprises, 736, N. Mills Ave., Lodi, CA 95240.

IMAA, c/o Bill Wilbur, Secretary, 6 Laurel Ave., Kittery, ME 03904. ■

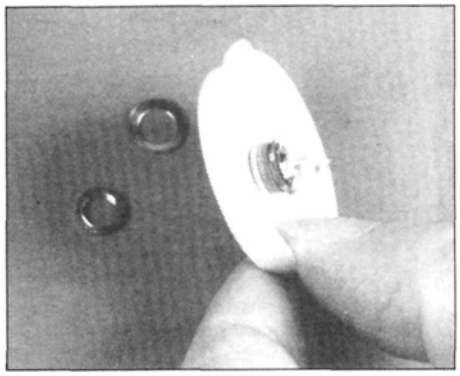
How To:

by RANDY RANDOLPH

MAKE A SIMPLE AUDIO TRANSMITTER SIGNAL MONITOR

Most of us have no idea what our transmitter actually sounds like. This simple, inexpensive device will give you the chance to hear the transmitted signal. It will also act as a rough check on the relative output of transmitters. The pictures show the way. The parts are available at Radio Shack retail stores and their catalog numbers are given in the parts list.

1.



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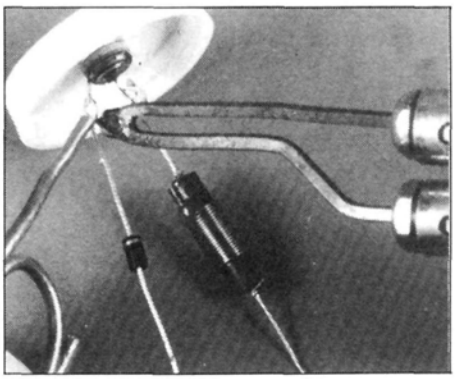

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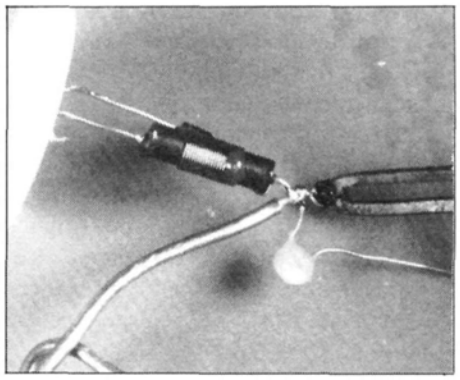

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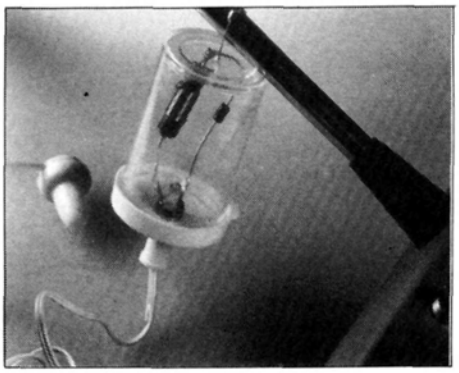

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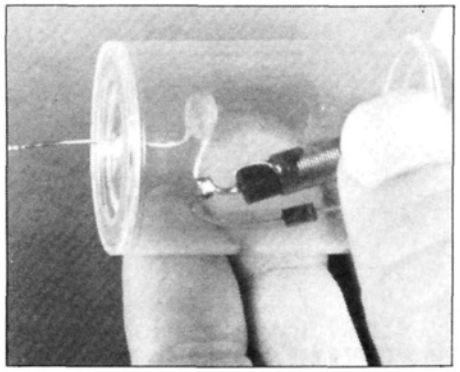


6.

1. The parts include a .001mf capacitor (272-126), a diode (276-1103), a 10uH RF choke (273-101A), a miniature phone jack (274-251), and a plastic prescription bottle with a non-childproof cap. A soldering iron, some solder, and a couple of drills are the necessary tools. Total cost is just over $3, with spares!

2. Drill a ¼-inch hole in the center of the bottle cap and mount one of the phone jacks (the package contains 4). The terminals on the jack should be on the bottle side of the cap.

3. Cut the leads on the RF choke and a diode to about 1 inch. Two of the terminals on the jack have small holes in them; solder the diode in one hole and the RF choke into the other as shown.

4. Bend the free ends of the diode and the RF choke toward each other, then twist them together and trim them to fit into the bottle. Solder them and one end of a .001mfd capacitor together.

5. Drill a small hole (1/16 inch) in the center of the bottom of the bottle. Thread the long end of the lead from the .001mfd capacitor through the hole and press the cap in place on top of the bottle.

6. Plug a transistor radio earphone into the jack and bend a hook in the wire from the capacitor to hang over the antenna of the transmitter. Turn on the transmitter and listen. (Stereo headphones will have sound in only one ear.)

From The Cockpit

B-25 MITCHELL BOMBER

article and photos by BUDD DAVISSON

THERE ARE TIMES when a pilot knows for a fact that he's in way over his head. It's frightening and it's exciting. That's how it was for me when I started working out in a B-25 Mitchell.

I got my chance to play with one of these big machines courtesy of Mr. Isaac Newton Burchinal, better known as Junior. He used to be the proprietor of the Flying Tigers Air Museum in Paris, Texas.

If you've seen even one WW II movie, you know you climb into bombers through belly hatches. In the B-25 that includes a hatch that drops a convenient little ladder that lets you climb up in style rather than trying to leap up into the overhead hatch. Remember when Gregory Peck couldn't pull himself up into a B-17 in *12 O'Clock High*? Remember how bad you wanted to help him?

When you climb up into the fuselage you find yourself in a small room about 6 feet square. The aft part of the room is taken up with the lower portion of the seat bottom and actuating goodies for the top turret gunner. The forward part opens up into the flight deck, which sits up on a platform that's about waist high. A little tunnel runs under the left side of that platform to the bombardier's position.

I remember the first time I climbed into a B-17 and thought how small the cockpit was for the size of the airplane. In the B-25, however, the cockpit seems just about right. When you crawl between the two seats, you can't help but step on some of the controls. Not to worry; they all have a dull shine to their edges that says they've seen the bottoms of a lot of flight boots long before you were born.

Once I was in the seat, everything seemed right; it didn't feel all that strange. The B-25 seems, to use a term that certainly didn't exist in its heyday, "user friendly." Even the instrument panel seemed familiar. In the old days they didn't have to worry about things like HSIs, flight directors, color radar, vertical tape gauges, and all the other sci-fi stuff we have to weed out when flying a modern airplane. The B-25 has what it needs—the appropriate manifold gauges and tachs for each engine and a few things like altimeters and airspeed indicators.

Something you won't find in your average Cherokee is an elbow-high console coming out of the floor that looks like a display stand for a salesman that specializes in selling knobs. There are prop levers, throttle levers, mixture levers, cowl flap levers, flap levers, lever levers, and a bunch of other things that all have black (with a few token reds) knobs on them. The elevator trim is a giant aluminum wheel on the left side of the console. That positions it nicely at your right knee. The all-important rudder trim is about half-way down the back of that console. All of the engine controls, as well as the feathering buttons, are on the top of the console within easy reach and are certainly easy to figure out.

During my visit to Paris (Texas style) I must have spent 8 hours sitting in the B-25's cockpit running through emergency procedures and making imaginary touch-and-goes.

I do this a lot when I'm trying to get myself geared up for airplanes that are more complex than I'm used to but I don't ever remember getting so psyched up about it.

Takeoffs in the B-25 are really a kick in the shorts. For one thing, there's the noise that comes rushing in from both sides as you bring the throttles up. With the short military exhaust stacks, every single decibel (and there are plenty available) comes rushing in to sit on your lap. At the weight most civilian B-25s fly, the acceleration is quite rapid. When first applying power, you might need a tap of break one way or the other to keep the centerline nailed until the wind in the rudders gets powerful enough. The only other thing you have

"I had visions of it giving one quick shudder and instantly flipping on its back as it dived for the dirt."

Active in battle fronts all over the world during WW II, the swift and lethal B-25 was a primary weapon credited with winning the war.

to do is bring the power up slowly and smoothly so the governors don't surge and so you hold 44 inches of manifold pressure.

As the runway rushed past and the noise closed in, I kept saying to myself, "Let's see, Vmc is 80 knots so I sure don't want to be in the air below that!" So I waited until I had 80 knots then I picked up the nose and let it run on the mains. At 100 knots indicated, it takes only a short tug on the yoke to put daylight under the airplane. I dropped my right hand to the bottom of the console, pulled the safety hook off the gear handle, and yanked it up, watching the three little wheels in the indicator windows change to striped squares.

Almost as soon as we started flying the airplane, we'd gotten up to altitude, lots of altitude. Junior showed me what the airplane


Executive Sweet

ll Bomber

Photo by BUDD DAVISSON

could and couldn't do. One thing it couldn't do is fly without airspeed, so we did a lot of stall series, just as if it were a Cub. I started the power coming back and the nose coming up and waited until the big mother quit flying. I had visions of it giving one quick shudder and instanly flipping on its back as it dived for the dirt. I was not only wrong, but pleasantly surprised. We didn't have a whole lot of fuel on board, and our bomb load was minimal so the stall didn't show up until we were clear down around 70 knots. When it broke it wasn't anything I hadn't seen before. Any modern twin is less well behaved. All I had to do is drop the nose, level the wings, and bring the power up, just as if it were a regular airplane. And as long as I didn't sit on my hands too long, we'd be back flying in only 1,200 feet or so.

Naturally, once you know how the airplane stalls, the next thing you need to know about a twin-engine airplane is how it handles when one propeller isn't propelling anymore. In the B-25 that means you have 1,600 horses on one side, galloping hard, while those on the other side are sound asleep. Believe me, when you shut an engine down on a B-25, there isn't the slightest question about which is the dead foot. The trick is to react fast enough so that both feet don't wind up dead, along with everything else. To prevent this from happening, Junior worked my buns off (I can't keep my jeans up to this day) in single engine work. For instance, when I was getting my multi-engine rating, I only saw an engine feathered twice. Junior, on the other hand, feathered one every time I took my hand off the throttle to scratch my nose.

There are two things to remember when feathering an engine on a B-25. First, remember the Vmc for your weight. Second, remember to move your fanny forward in the seat because you have to be close to 7 feet tall to have enough leg to get the rudder down as far as you want it. I had to practically lay sideways in the seat, with my shoulder against the back, to get enough body length and strength. While doing this, my right hand was cranking like crazy to get enough rudder trim in. Once the trim is in, the airplane is a pussycat, albeit a big one. But this is one pussycat that will eat your leg off right up to the knee cap if you don't get the trim in fast enough.

The handbook says the minimum single engine control speed is a whopping

(Continued on page 74)

The B-25 was one of the most heavily armed aircraft during WW II. In addition to the tail guns, the bomber carries a 75 mm cannon and eight .50 caliber machine guns in the nose, two upper turret guns, and two waist guns.

Pattern Matters

by MIKE LEE

THE AMA NATIONALS are just about here. Many of the more serious pilots within the pattern fraternity attend the Nats for a good reason: it's there that national recognition and prestige can be won. For some, that's what the game of pattern is all about.

Here's a list of things to take and do before you hit the road. Don't forget, the road to the Nats can be long.

First off, no matter how well polished you are, you need to be prepared mentally and equipment-wise. The mental preparation comes in the form of confidence to do the maneuvers correctly and consistently, and in front of tough judges! Confidence can only be built up by flying a lot.

You must fly regularly. True, burning 10 gallons of fuel a week doesn't do much for you or your pocketbook, but if you fly with certain goals in mind every time out, then you'll gain confidence. Fly to *improve* the maneuvers, not just to do them. Each of us has certain flaws in certain maneuvers on which to concentrate.

You can build up your confidence even more when you fly in local contests. Here is where you can see how your practice has prepared you. Most of us get blown away the first couple of times in local contests. It makes you want to walk away with your tail between your legs. But this is one of the best acid tests around. If you perfect the maneuvers you botch, you'll be winning and building your mental confidence. Now you're mentally ready for the Nats.

What about equipment? If you think like I do, you prepare for the absolute worst situation. Imagine traveling a long distance to get to the Nats, only to make a fine impression on the earth with your one and only plane. Sure, the plane cost a bundle along with the mangled radio and engine, as did the cost of just getting there.

A back-up aircraft is nice to have and a lot of seasoned pilots have one. You should also have a supply of the things that fail the most, such as glowplugs, fuel, fuel lines, servos, batteries, retracts, props, etc. These are things that can stop the bird from flying. The Nats is one place where you need every flight you can get, so bring enough spare parts to keep the bird airborne.

Joe Gross of Oklahoma City flies a Thunderbird. He always brings an indentical back-up ship.

Jerry Budd, left, and Scoot Spreights, right, shared Carl Nicklos' bird after losing their own.

Also bring some building materials with you in case you have to make repairs. Extra wood blocks, a length of sheeting, covering material, glues or adhesives, hobby knives, sandpaper, etc., are good to start out with. You've come a long way already and the extra materials won't take up much room—they could even save the day for you.

You also need to think about your radio and other support equipment. These items can sometimes fail as well. The radio should be labeled with your name and AMA number for easy identification. In 1984 I helped process over 1,000 transmitters at the Nats and when you get just 10% of them in one impound, finding yours can be a headache.

It's also a good idea to have the radio system tuned up *before* the start of the flying season. I guarantee that you'll be real perturbed if your radio doesn't pass inspection during transmitter processing.

Make sure that all your other equipment is in good shape and works as it's supposed to. That includes the 12-volt battery, power panel, chargers, connecting wires, plug wires, fuel pump, and meters. Don't forget hand tools. Just pack everything imaginable that you might need.

By this time you probably have at least half your workshop in the car. But like I said, it's a long way to the Nats and you should be prepared for the worst. Decide

what the most important equipment items are and don't leave without your mental confidence. It will carry you through the toughest times and make the road to victory easier.

Diesels in Pattern

Some time ago, I began a little experiment with diesel engine conversion in a pattern ship. I started out with a *M.A.N.* CAP 21 from an I.M. kit. It was equipped with a Webra .61 side exhaust, a J.R. Apollo 6-channel radio, and standard servos. All up, the ship weighed 6.75 pounds and performance was pretty sharp. Then I began the diesel experiment.

I received a diesel head conversion kit for the Webra from Davis Diesel Development*. The whole conversion consisted of merely removing the standard cylinder head and replacing it with the diesel head. The fuel system tubing had to be changed to neoprene tubing to allow use of model diesel fuel. The whole conversion took about half and hour.

After reading the instructions carefully, I was mildly surprised to have an engine that started rather easily without the glowplug. The engine performed well, with a 13x6 prop. Normally I use a 12x6 prop and get 12,000 rpm. With the diesel conversion and the larger prop, there was a loss of 1,000 rpm, but the airframe performed the same. This means that the engine and prop combination provided the same amount of thrust and power.

The idle of the engine went down to 1,100 rpm, reliably, and fuel consumption was ridiculously low—the 12-ounce tank was sufficient to fly for over 20 minutes.

I tried a number of other prop sizes to see what would happen. Smaller props

Lee used the M.A.N. CAP 21 for diesel experiments.

didn't do much except bring the rpm up a bit. In this case I lost the usable portion of the torque curve as the engine was over-revved.

The CAP 21 has gobs of ground clearance which allowed me to go to 14-inch props and a I experienced only a slight decrease in airframe performance. The prop was absorbing a lot of horsepower and in return, the airframe twisted with the torque.

I finally arrived at the optimum prop: a cut down 14x8 prop that measured 13x7.5. With this prop, I recorded a top rpm of 10,500. Idle speed was still 1,100 rpm and fuel consumption was ½ ounce per minute. Airframe performance was improved over the glow engine version in the climbing vertical maneuvers but slower in the horizontal flight.

So, what does all this mean? In a nutshell, I have found the Davis Diesel Conversion head to be feasible for pattern performance in the CAP 21, which has a pretty honest airframe. The conversion allowed this ship to perform better vertical maneuvers, slowed down the horizontal flight speed, received better mileage, and it was quieter! The diesel conversion produced a sound that was a cross between a four-stroke and a well muffled two-stroke.

All in all, the Davis Diesel Conversion was a pleasant experience. One note of caution with diesels—don't flip the prop unless you mean to start the engine. Believe me, that diesel engine will start!

That's all for now, but stay tuned for more interesting news; I've moved to San Diego, California, which is the heart of pattern country. I'll make sure that you get the latest in pattern trends as they happen. 'Til next month, I'm on the pipe in California.

Author Mike Lee found the Davis Diesel conversion a viable alternative for pattern. See text.

Mike Lee, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following is the address of the company mentioned in this article:*

Davis Diesel Development, P.O. Box 141, Milford, CT 06460. ■

FROM THE COCKPIT

(Continued from page 68)

126 knots (145 mph). Junior says that's not necessarily a believable number since it changes so radically with your gross weight. We found that at our weight of around 22,000 the airplane would truck right on down to 80 knots indicated and I could still hold the nose straight. We did so many single engine stalls that I developed an instantaneous reaction for hauling the good throttle back.

On my first landing I flew a wide downwind at 120 knots. I ran through the checklist as fast as I could, since the airport was disappearing fast. With Junior playing co-pilot, I called for the gear and at the same time pushed the props up to 2,200 rpm. The mixture went to auto rich and the boost pumps first went into low and then high. By this time I was well past the airport so I brought the power back a little and started my turn on to base. The second I started the turn, the airplane reminded me that it was indeed heavy and started falling from the sky. I grabbed a handful of horsepower and things settled down again.

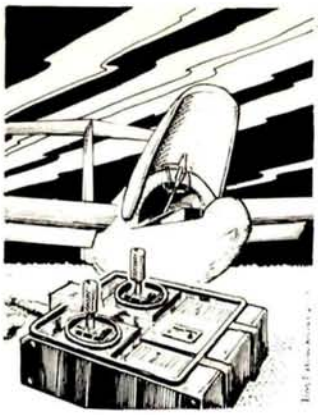
On base I was using a heck of a lot more power than I would have believed to stay on profile and was working the trim constantly. I stuck up two fingers for half flaps and as I turned final, four fingers went up. My right hand inched the throttles up as a dirty airplane got that much dirtier. I was looking for 110 knots over the fence.

I was worried about making the runway so I kept a fair amount of power in it. But Junior started yelling (you always yell in a B-25) about killing the power or we'd never get it down. Obediently, I brought the throttle back and kept my nose pointed right at the runway.

I had to keep reminding myself how high I was sitting off the ground and how long those landing gear legs were. So I started bringing the nose up and Junior started yelling "Pull, pull!" I couldn't believe how high he had me get the nose. It was as high as it would have been in any tailwheel airplane and the visibility wasn't one damned bit better. All I could see was a little bit of the runway out of the left corner of the windshield.

Rollout was as straight as tricycle gear could make it and I kept reminding myself to go light on the brakes. In taxiing the airplane I had found that the multiple-disc brakes could be locked up

(Continued on page 78)



Soaring News

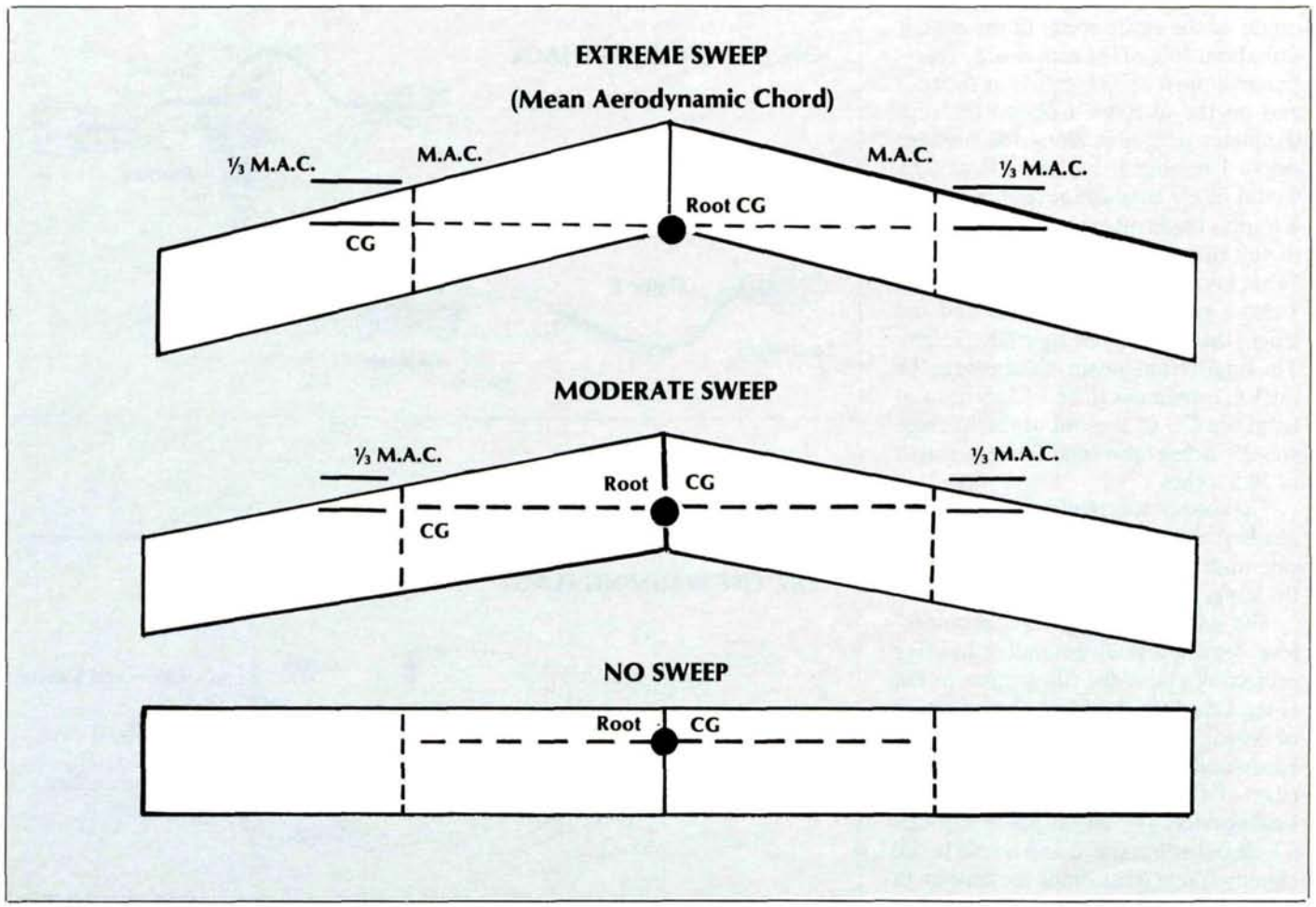
by JIM GRAY

A WEEK AGO, my young friend Ty Sawyer and I took my new two-meter design (you'll laugh when you hear how much of a "design" it is), out for its maiden flight. The batteries had been charged and everything was ready. The "new" design consists of a fiberglass fuselage from my friend Bruce Abell in Australia, a pair of Obechi-veneered foam wings featuring an Eppler 193 airfoil by way of Jerry Slates (Viking Models), and an all-flying stabilizer from Jim Tyrie's Sagitta 600. The fin was self-designed (big deal!) and the rudder was from my old Sagitta 900.

The fuselage had been around for nearly two years and I finally decided to remove it from its packing bed and began to sketch out in my mind just where a pair of wings ought to go, leaving enough room ahead of the wing for battery, receiver, and ballast—if needed—plus a switch harness. The fuselage is rather narrow, so length was essential. Servos could easily mount underneath the wing in the slot I planned to cut out.

The wings are constant-chord and each panel is 35 inches long. I decided to use a swept-back configuration for the plan form—about 7½° on each side looked about right. As for dihedral, I also chose 7½° to match the sweep. Sweepback provides a bit of effective dihedral and I feared that maybe I'd have too much and get into the Dutch Roll problem with insufficient vertical fin/rudder area. That's why I used a large rudder that was intended for a 100-inch span instead of a 2-meter span.

I don't particularly care for wing rods, tubes, braces, spars, etc., especially when you have to insert them into a foam wing that is already skinned. I chose a one-piece wing. I carefully cut and bevelled



the root of each panel to match the sweep and dihedral, blocked the tips, and epoxied the roots together. Then, using a piece of 6-ounce fiberglass tape, 3 inches wide, I made a "bandage" around the glue joint, liberally covering the tape and wetting it for good adhesion. When finished, the wing was as stiff as an ironing board.

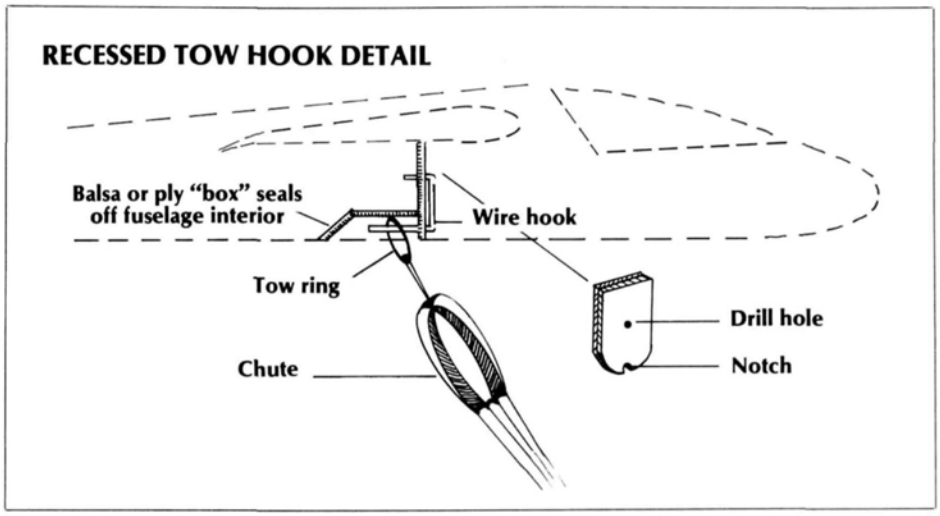
I carved two wing tips from blue foam (a 5-minute job with file and sandpaper) and covered them carefully with MonoKote. I covered the wing panels with white MonoKote and merely Scotch-taped the tips in place.

For a one-piece wing like this, it's necessary to cut the fuselage away in order to mount the wing. I made two templates of the wing root and taped them to the sides of the fuselage. Now for the critical decision: where should I place the wing?

The method I used will work for you too. Mark the "mean" chord of the wing on each panel. (For a plank wing, it's exactly half way out on each panel.) Next mark the approximate location of the CG on each chord line. I used 1/3 of the way back as a guess. Now connect the points on the mean chord line with a straight line and see where it crosses the center of the entire wing. In my case, it was about 50% of the root chord. This is the preliminary CG location at the root and on the fuselage. I placed the root templates in a spot along the fuselage where I reasoned that the CG at 50% would nicely balance the sailplane. This is a guess based on experience and I have to say that I used the TLAR method: "That Looks About Right!" The position I chose gave a generous nose and tail length that seemed just right (see sketch). The length from the tip of the nose to the the CG turned out to be 14.5 inches and from the CG to the end of the fuselage was 25 inches for a total fuselage length of 39.5 inches.

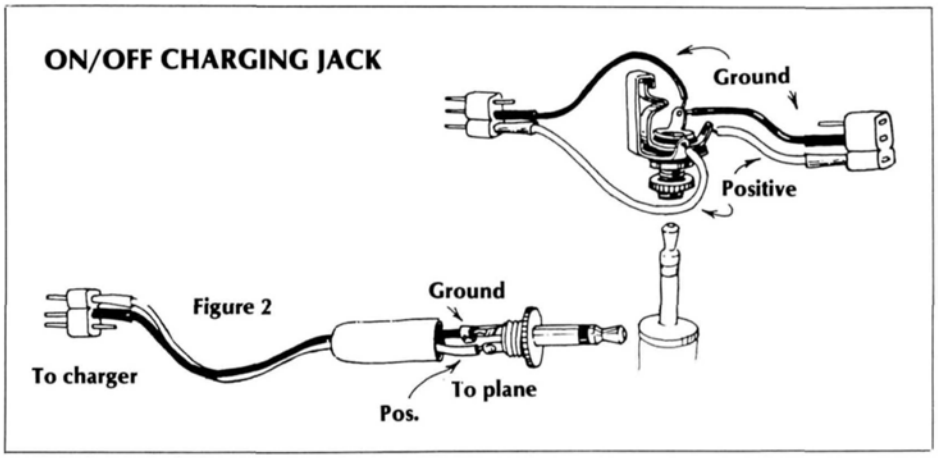
The cut-out was reinforced with bulkheads at either end, plus strips along the side under the wing root for mounting the wing, as a "platform."

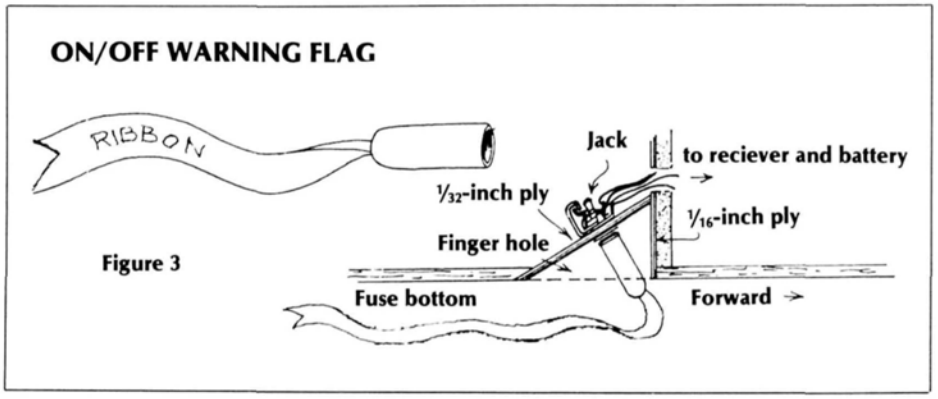
The wing is mounted at "shoulder" level, leaving a small amount of fuselage projecting above the top surface of the wing. I used the dowel and bolt method of fastening the wing in place: a block of hardwood in the fuselage at the trailing edge of the wing and a dowel at the leading edge. The dowel passes through a hole in the bulkhead and a hole in the canopy frame (that holds the canopy in place, too. See sketch.)

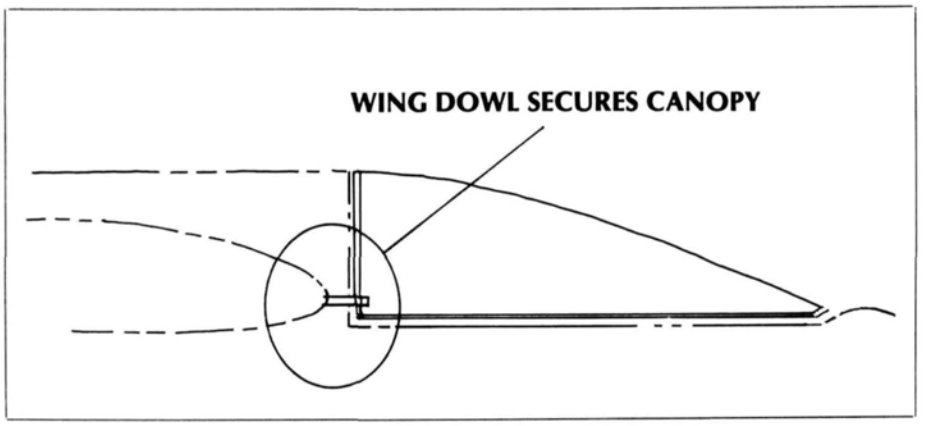


The stab is all-flying so an internal horn had to be fitted to drive the stab. I buried the antenna inside the fuselage and used a hidden tow hook arrangement (see sketch). The switch for battery On/Off is a plug and jack type designed and used by Ty on his Flinger and other sailplanes. They are illustrated here by Bob Rondeau and reprinted with permission from *R/C Soaring Digest*. The only projection, therefore, is the rudder control rod and horn. I'd like to be able to bury that too for a really low-drag ship.

The CG came out almost exactly where it was planned, meaning that very little nose weight was needed for balance.







I added a bit anyway for the first flights. A run into the wind with Ty holding the glider but not letting go showed that it wanted to lift straight out of his hand. A second run allowed it to float above his hand for a few yards—straight as an arrow. The final run was a hand launch which carried the sailplane about 200 feet. (Wing loading is 10 ounces per square foot.)

You must know how I felt when I launched my glider for the first time using a winch. But I need not have worried. Up it went, straight and as if on rails. We made about ten flights in all, worked several thermals, and made some low passes and pull ups. The notable features of this machine are stability, yet sensitivity to lift; very good penetration into wind; and an extremely flat glide. I attribute this result to the overall clean design plus the wing tips, which extend out from the bottom surface like wing extensions, which they are, but taper down from the top surface until they meet the edge. In plan view, they sweep back at about 45° from the wing itself.

That's about it for the 2-meter. Normally, I wouldn't rave on so about what is a very prosaic or commonplace design except that there are some novel aspects which result from some early decisions. Perhaps it will give you an opp rtunity to adapt some of these ideas to your own original "design." The sketches may help you visualize these ideas.

Jim Gray, c/o *Model Airlane News,* 632 Danbury Rd., Wilton, CT 06897. ■

FROM THE COCKPIT

(Continued from page 74)

easily and it was hard to make a smooth stop. Even the lightest tap seemed to be too much and as the nose gear compressed, we hippity-hopped down the runway.

Even though I eventually earned a type-rating in the bird, my days as a B-25 driver are behind me unless I can find someone who needs a low time B-25 driver (and who doesn't want me to haul questionable freight from questionable South American locales). But that's all-right. At least I've tasted the tiniest little morsel of an era I missed. I know the noise and vibration, the view through the mail slot windshield, and the satisfaction of putting it down on the mains, keeping the nose up until I'm ready to lower it. What I don't know is the awful acid taste that comes from an airplane full of .50 calibers spitting lead in every direction. I'll never know, nor do I want to, the relief that comes from surviving another mission.

I've lived out one small fantasy and I've added another line to my license. Granted, B-25 type-ratings aren't much good these days, but they sure do come in handy at parties when it comes to playing one-upsmanship.

A beautiful, full-color poster of the North American B-25 Mitchell is available from Model Airplane News *on pages 128-29 of this issue.* ■

SPEEDSTER

(Continued from page 40)

inch basswood strips glued to the stab and the vertical fin. This treatment results in a very realistic appearance with very little extra work. Final assembly is straightforward. I covered my model with Top-Flite's MonoKote*. The difficult areas were painted with matching Pactra Formula U. All up weight was exactly 6 pounds, 4 ounces. This works out to a wing loading of 24.4 ounces per square foot.

FLYING. Having the same airfoil as the Craft-Air RV-4 that Chris Chianelli and I tested in the March '86 issue of *M.A.N.*, and keeping in mind our success then, I was not very surprised to find the Rearwin a pleasing model to fly. The thick symmetrical section not only makes for good slow flight but also provides the Rearwin with a lot of aerobatic ability. Knife-edge manuevers were a bit difficult to keep on a heading, but then again, this

type of aircraft was designed with other intentions in mind. Nevertheless, snaps, spins, stall turns, and inverted flight were easily done with this model. As already alluded to earlier, slow flight, hense landings, are at a trainer-like speed.

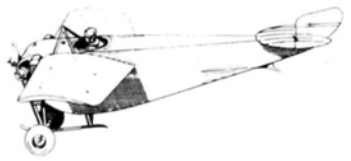
Craft-Air has created a fine kit out of an elegant original. With its gracefully curved wing and full-bodied fuse it's guaranteed to stand out from the cookie-cutter sport pattern planes. Combine it with a four-stroke and capture the sound as well as the shape of a classic. If you ever get a chance, head out to a country field or local airshow. Watch the cabin singles as they takeoff and land. Remember the long run and gentle climb out. Not every landing is glass smooth; a few light bounces then a gradual rollout. Fly the Speedster this way some quiet afternoon and you just might begin to believe it yourself.

**The following are the addresses of the companies mentioned in this article:*

Craft-Air, 6860 Canby Ave., #120, Reseda, CA 91335.

Top-Flite Models, Inc., 2635 S. Wabash Ave., Chicago, IL 60616

Pactra Industries, 16946 Sherman Way, Van Nuys, CA 91406. ■



SPEEDSTER 6000

(Continued from page 42)

Note: The aircraft was available with a Menasco B-4 engine as well, on special order (SN.302)

The airplane was built of typical steel tube (4130 chrome moly welded steel) fuselage construction. The wings used laminated wooden spars, built-up wood ribs with typical bracing and was fabric covered. It was a joy to fly and fast for its power and size.

It's a difficult plane to document and the scale judges can't knock you if you use the material as presented in the kit. If you want something different, study my photographs or refer to *U.S. Civil Aircraft* (Juptner), Volume 7, pages 186-188 and you can decide how to do this one. ■

INSIDE TRACK

(Continued from page 85)

replace bearings that have siezed.

Grease should be applied to the differential if you have one. Older cars don't have one, however, most all new cars do. The most effective type is the ball differential, which normally has six to eight balls inbedded in the main spur gear to provide the differential effect. These balls require a high-temperature grease. Silicon-based grease works best here and is commercially available from a number of manufacturers.

The crown gear differential, found in cars that have their differentials housed internally of the gear box, can also use the grease but depending on the manufacturer's recommendation, a heavy oil may be more appropriate.

At any rate, there are three kinds of lubricants to have handy and if you're really into lubes, you can get a set of different weights of oil just for the shocks. This will allow you to custom tune the dampening for any track condition just by changing the shock oil.

Lubrication is one of the necessary evils of the sport. One weight of oil can't do it all. There are proper lubes for every item on the car. There is even one for the speed controller and wiper assembly to prevent arc burning due to throttle movement. The result of having the right stuff will be a consistently fast car that will last a long time. Keep things oiled and keep that foot to the floor.

Mike Lee, c/o *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the companies mentioned in this article:*

Polk's Modelcraft Hobbies, 349 Bergen Ave., Dept. 20C, Jersey City, NJ 07304.

Associated Electrics, 1928 E. Edinger, Santa Ana, CA 92705. ■

R/C VIDEO

(Continued from page 22)

noise is exactly like being in a Mustang or a Corsair. Looking through the windshield at the cowl and the spinning prop is a sight you will only see in those kinds of airplanes, especially when you consider the maneuvers I did—low inverted passes that make you hold onto your chair! The ten-turn spin is astonishing and seeing the horizon rotate around 360° as you go through point rolls is spellbinding. On top of that, I added sound effects from a WW II movie. Gun bursts, screaming bombs, and music all add to the effect.

To get a copy of the tape write to me and I'll have one made for you. If I get enough orders I may just make it available for everyone. The price will be about $20.

Since the Panasonic PV 200 is a rather large camera and weighs 9 pounds, it takes a good size airplane to carry it around. Shortly after I shot the tape with it, Sony came out with their new 8mm Pak-Eight system. Their camera only weighs 3 pounds. Naturally I had to get one.

The possibilites of this combination—a model with a video camera—are staggering. Commercial uses for this setup abound. The only limit is your own imagination.

About the only thing to consider, aside from weight and balance changes,

is mounting the camera. Since video cameras use a floating magnetic head to transfer the image onto film, keeping it isolated from the vibration of the engine was a major task. I found that I simply had to mount the camera as "softly" as I possibly could. Now the quality of the film is quite good. Without it you get a lot of "noise"—breaks in the sweep continuity caused from the head vibrations.

The beauty of this experience is that, after a day's flying, you can go home, eat supper, and go flying again. Only this time it will be in your living room! ■

ROYAL B-25

(Continued from page 45)

passes. The first few were at full bore and quite low. This model is very easy to keep on a heading and really falls into a groove. High-speed low passes with a beautiful twin like this are real crowd-pleasers.

Later I was told by an onlooker that Louis dropped his camera to his side and just stared with his mouth open. Knowing the spectrum of Louis's facial contortions, I wish I could have seen this one myself. I'm sure he looked like a German field marshall driven into the throes of catatonic hysteria by the droning Mitchell, knowing that at any moment she would give birth to a litter of deadly babies. Louis told me later that the B-25 was definitely one of his favorite models to photograph and he's photographed hundreds.

After some inside loops, a couple of axial rolls, and an Immelman, I made many half and third throttle low passes for the camera. It was now time to land. The Rhom-Air gear came down without a hitch. I wasn't very nervous because I now knew the B-25 had all the ability it did almost two pounds ago. The model has a very predictable rate of decent and makes very pleasing nose-up, mains-first, flared type landings. All in all, my experiences with the Royal B-25 have been very fulfilling ones and I'm sure my opinion is no different from any other proficient sport flier.

The B-25 Mitchell was ordered off the drawing board in 1939. It was pressed into service due to the desperate need at the time. The first major task the B-25 undertook was the famed Doolittle raid on April 5, 1942, when B-25s took off from carriers to bomb Tokyo. Some members of the Japanese military upper echelon felt that the U.S. was alseep at the proverbial switch. I'm sure Doolittle's brave undertaking forced them to re-evaluate their perceptions. As the expression went back then, "Doolittle do-od it." Trust me, so can you with the well-engineered Royal B-25.

**The following are the addresses of the companies mentioned in this article:*

Royal Products, 790 W. Tennessee Ave., Denver, CO 80223.

Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.

J'TEC, 164 School St., Daly City, CA 94014.

Coverite, 420 Babylon Rd., Horsham, PA 19044. ■

CONTROL TOWER

(Continued from page 57)

flap to elevator mixing when the flap/elevator switch is in the 6-2 mix or the elevator/flap switch is in the 2-6 mix position. The flap/elevator mixing switch is to the right of the elevator mixing knob. This switch controls the aforementioned mixing with the neutral switch position Off—no elevator/flap mixing. The last control on the upper right side is the aileron dual rate switch; On is forward.

Rounding out the transmitter front panel are the power-battery meter, the neck strap loop, the power On/Off switch, and two sticks. Both sticks are of the closed gimbal design and operate smoothly. The length of the sticks is adjustable ¼ inch. Mode II configuration is employed with motor and rudder on the left stick and aileron and elevator on the right. Electronic trim controls are employed.

The balance of the transmitter controls are located on the rear side under a removable cover. Starting on the left is the channel 1 aileron dual rate trimmer. Turning this control clockwise allows you to vary the aileron throw from 100% to 40% when the aileron D/R switch is in the On position. Moving right there is the elevator dual rate trimmer. It operates the same way as the aileron dual rate control.

Next is the aileron/rudder mixing switch. When on, the aileron and rudder move together from the aileron stick. With this switch On, the full aileron and rudder servo travel is reduced by about 40%. This ratio is not adjustable. The 2-6 mixing control is next. It lets you set the amount of elevator you want mixed with a given flap movement. To adjust this, the elevator/flap switch on the front panel must be set to the 2-6 position. There is also a flap volume control which allows the desired adjustment of flaps with the elevator.

The remaining controls are the six servo-reversing switches. Down is normal and up is reverse throw. Rounding out the transmitter is a charging jack on the lower right side if you decide to use nickel-cadmium batteries.

The Challenger 620 reciever is advertised as a 1991 receiver which means it has a pass band only 10 kHz wide. I wanted to check this but because of the unavailability of test equipment, it wasn't possible. I'll have a report in a future column.

The receiver is a dual conversion receiver with the first IF at 10.7 MHz and the second at the familiar 455 kHz. The operating channel crystal is replaceable and removable from the outside of the receiver case.

The Hi-Tech Challenger 620 is a classy 6-channel radio system with many desirable features at a very reasonable price. It's well-made and performs as advertised. When you buy your next radio, take a look at this one.

Charlie Kenney, c/o *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897.

**The following is the address of the company mentioned in this article:*

Polk's Modelcraft Hobbies, 346 Bergen Ave., Jersey City, NJ 07304. ■

4-CYCLE FORUM

(Continued from page 49)

instead of a pump, because I needed muffler pressure for my two-tank setup which, by the way, works great. I read in your column in the April 1985 issue about Dick Roush, who put an O.S. carb on his Enya. It sounds like he put his carb on with the needle-valve sticking out the left side. I put mine on the right side as per the original Enya installation.

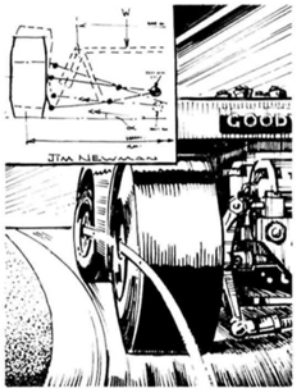
"All it involved was drilling and tapping one 4-40 hole. The carb was installed with a 4-40 socket-head screw with two lock washers. The Enya intake tube fit into the O.S carb with no cutting of any kind. Using a 3/16-inch spacer, the Enya choke fit on the O.S. carb perfectly. A flat washer was substituted for the lock washer on the choke. A short length of 1/32-inch wire with a loop on both ends and a spring from a ball point pen holds the choke open.

"One end of the 1/32-inch wire is held to the engine under the crankcase vent fitting. The plastic sleeve from the Enya carb was a good fit on the O.S. carb.

"Instead of using extensions on the needle-valve and choke, I ground down the threads on a ½-inch 4-40 socket screw to fit the holes (in the end of the needle-valve). Setscrews hold the 4-40 screws in place. The smallest Du-Bro Allen wrench fits through a small hole in the cowling to operate the choke and needle-valve. The engine starts easily and runs nicely with muffler pressure and the two-tank setup."

Well, this sure looks like a minimum machining operation, doesn't it? Even if

(Continued on page 86



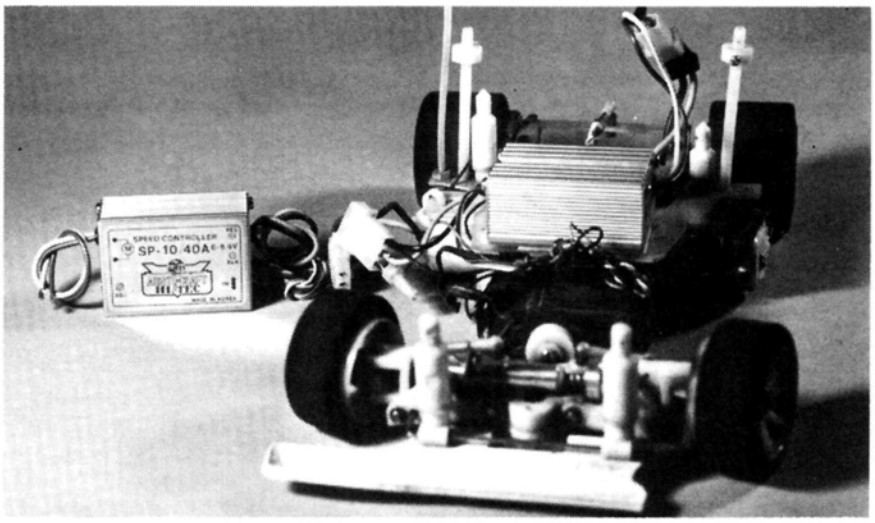
Inside Track

by MIKE LEE

LET'S TAKE A LOOK at a new speed controller for the sport competitor from Polks Hobbies*. The Polks Model 1040 Electronic Speed Controller is a self-contained controller designed to handle six-cell electric motors with cars, boats, or aircraft. The unit will handle a nominal power loading of 10 amps with maximum power surges up to 40 amps. This makes the speed controller satisfactory to use on high-power road-racing cars and off-road cars with stock motors. Of course, depending on the particular motor being used on your off-roadster, a more powerful motor would probably be safely fed with the Model 1040 on six cells.

The Model 1040 is housed in an extruded aluminum casing, which also serves as the controller's heat sink to dissipate heat quickly. This model features an adjustable neutral setting/brake adjustment, full forward only. Three sets of wires exit from the controller casing: one for incoming battery power, one for outgoing power, and one for the receiver signal. Molex miniature connectors are furnished and are compatible with the Challenger series of radios. Other radios can be used by simply switching the end connector. The outside dimensions are 2⅜x1½x1 inches. Weight is 2 ounces, making it about the same weight as a normal servo, resistors, and associated wiring or wipers.

The Model 1040 Speed Controller has a fairly linear performing power band. The unit is easily adjusted, allowing the pit crew to perform fast tuning without having to stop the adjusting pot on a gnats tail to get it right. The power flow is about equivilent to using a multi-banded speed resistor rated at 1 ohm. The power comes on fast when punched, or can be feathered in with the throttle trigger. Because there are no power drop statistics available, I can't provide you with this information, but the Model 1040 is an outstanding value for only $22.50. If you're interested in trying one, see your local hobby or write to Polk's Hobbies. Tell Lewis Polk that you saw it in "Inside Track."



An easily adjustable speed controller is a definite plus when setting up an electric but can also be expensive. Polk's new Model 10/40A is a real value at $22.50

Now that I'm on the subject of electric motors let me tell you how to take better care of that motor in order to make it last a lot longer. I've already discussed the fact that you must keep the motor clean to help it perform at tip-top shape, but it occured to me that a little cleaning advice could go too far.

As I mentioned, our cars are very close to the ground making them susceptible to dirt, dust, and other foreign gunk. Eventually the motor will be damaged if the garbage isn't removed. Spraying the motor with a good motor cleaning spray is a good way to remove the garbage. Dipping it in some commerically available cleaning solvents and washing it real well is also good. But there's a point at which this cleaning madness must stop. In the case of electric motors, a little is good but more is bad!

Electric motors are really very frail so the people who make these motors take their time to see to it that every motor is not only properly assembled, but that it's properly lubricated. Most of you know about hitting the main bearings with oil, but how many know to lubricate the brushes? Don't feel bad, neither did I until my friend Gene Hustings from Associated Electrics* enlightened me.

Gene explained that in order to provide the motor with the optimum brush contact, the brushes are made of a copper and graphite compound. The copper portion provides the electrical continuity and the graphite provides a method of lubrication. But the graphite still needs help so, in addition to the graphite, a special lubricant is applied to the brushes to assist in keeping wear and tear to a minimum while still allowing proper brush contact. Cleaning the motor not only removes the dirt, but the lubricants as well. That means that you must lubricate the brushes that you just removed. If you don't the brushes will do two very bad things: they will wear down very fast and usually not in a uniform pattern, and they will begin to dig into the commutator and wear it out in short order. The end result is a motor that goes

slower and slower at a faster and faster rate.

One of the worst things you can do to a motor is to dip it in water or cleaning fluids for more than a second or two while it's running. If you do, the motor

Keeping your electric motor clean and lubricated is the key to success. See text.

brushes will completely wear down within a minute or so and the commutator will be destroyed long before then.

To properly clean a motor, remove the motor and expose all vents. If you use motor spray don't turn the motor over with battery power. Hand rotation is fine but only enough to hit all sides of the armature and commutator. If you dip your motor, you can apply power, but only enough so that the motor just begins to turn. The motor should only run for a second or two and then be pulled out. In either case, allow the motor to dry then lube the bearings with oil. Lube the brushes with a motor power spray, such as Associated's Reedy-In-A-Can Power Spray. This will restore the brush lubrication to normal and lengthen the life of the motor.

Power sprays should be used on your motor after every run. Running the motor uses up whatever lube is present; dirt absorbs it as well. Spraying after each run will ensure that the brushes are properly lubed at all times.

How often should a motor be cleaned out? Road racing motors should be cleaned after every 8 to 10 runs. Depending on the road conditions, this can be shorter or longer. Just keep an eye on the motor and watch for excessive dirt build-up. And, if you can get to the endbell to see the commutator, you can see just how much dirt is building up inside where it counts.

Off-road motors should be cleaned after every third or fourth run, depending on track conditions and whether your motor is sheltered away from direct exposure to the dirt. A dust cover is a great help in keeping dirt to a minimum.

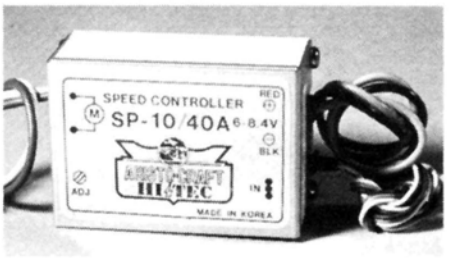
That about sums it up. Remember to keep the motor clean, but do it carefully. A little will go a long way, and too much will result in a worn out motor before its time is up. Use a good cleaning solvent and don't forget to lube all points of the motor, including the all-important brushes. You'll find that your motor will live a much longer and happier life.

Oils

Let's discuss oil; what type to use and where. There are two basic types of oil and one type of grease lubricant that all racers should have in their tool boxes. The oils are for motors and wheels, while the grease is for other parts.

The first kind of oil is a lightweight machine oil. A popular brand is the familiar 3-In-1 oil. This is a high-quality 5 weight oil of with good film strength so it will hold up to the strenuous rigors of model car abuse even when you forget to keep things lubed. The higher the film strength, the better off the car parts will be. And, you'll be able to go longer between lube jobs.

The lightweight oil should be used in three main places; the motor bearings, the axle bearing and transmission, and the wheel bearings. For those cars that use a chain drive system, it's not such a bad idea to use some on the chain as well. In cars that have standard bronze or oilite type bearings, frequent lubrication is mandatory. If this type of bearing is



The Aristocraft speed controller from Polk's can handle a power surge of up to 40 amps and weighs only 2 ounces.

allowed to run dry, the bearing surface will be destroyed within seconds and the result is a loose bearing which creates a lot of drag.

On the ball type bearings, an even lighter oil is more appropriate. A heavy oil won't penetrate well, and when it does, it tends to gum up the ball races and makes things worse than if no lubrication at all was present. A jeweler's oil, if you can find it, works very well on tiny ball bearings.

Lubricating the axles, wheel bearings, and motor bearings should be done every 15 to 20 minutes while running. This may sound like a lot but with this kind of lubrication, there really is never too much. Besides, it's much easier and less expensive to clean off any accumulated dirt from over oilings than it is to

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4-CYCLE FORUM

(Continued from page 82)

you don't own any Enyas, or are happy with the way they operate with the original carburetors, Bud has a good suggestion which should be remembered: don't use long extensions on needle-valves. Depending on length, it will have a resonant frequency which, at certain rpm, will cause it to vibrate violently, sometimes enough to change that correct setting you worked so hard to get.

On needle-valves that end in a length of wire, and not in a drilled knob such as the Enya, I cut a screwdriver slot in the end, using a cut-off wheel in a Dremel Moto-Tool. Then I set the needle with a small screwdriver on whose blade I've slipped a length of metal or plastic tubing to help align it with and keep it on the needle. Both systems will work and might help to alleviate some of that needle-valveitis we see so often.

Eloy Marez, c/o *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897. ■

ELECTRICS

(Continued from page 53)

and Larry Jolly in the Aerobatics event. In pylon racing, Mike Charles showed off the most impressive design, the Avanti; a world class 7-cell pylon model. It was the fastest, though Larry Jolly's new Ohmen ship with an Astro Cobalt 05 came close to Mike's speed. Mike's model suffered wing hold-down failure in the second heat, pushing him down to third place, but both Mike and Larry were doing 10 laps (circuits) on the 300-foot course in under 1 minute, 40 seconds.

Among the entries in Scale, three models really stood out as unique. Bill Young's Stephens Akro was well done and flew flawlessly. It featured a radio-operated scale smoke system. Brian Chan's Bede 5A (pusher), flown by Steve Neu, was really an impressive flyer. Addie Naccarato brought a Ritz Standard, which was a stick-builder's dream. It flew well until a strut failed (as happened with the full-size Standard, killing the pilot) causing one wing panel to sheer off. It was a sad but scale ending.

The 12th Annual Champs are history, but it was really worth doing it again and I look forward to next year.

Here are the results, to third place, for each R/C event.

Seven-Cell Sailplane. Twenty-five entries, 45-second motor run, 7-minute precision duration: 1. Ed DePue, Original, Astro Cobalt 05; 2. Paul Hingtgen, Electra, Astro Cobalt 05; 3. Don Nigg, Original, Astro Cobalt 05.

Open Sailplane. Eleven entries, 30-second motor run, 7-minute precision duration: 1. Craig Christensen, Olympian, Astro Cobalt 40; 2. John Lupperger, Electragnome, Astro Cobalt 05; 3. Frank Chasteler, Original, Keller 50.

Seven-Cell Old Timer. Thirteen entries, 1-minute motor run, 7-minute precision duration: 1. Paul Hingtgen, Playboy, Astro Cobalt 05; 2. Bob Sliff, Playboy Astro Cobalt 05; 3. Larry Jolly, Interceptor, Astro Cobalt 05.

Open Old Timer. Nine Entries, 45-second motor run, 7-minute precision duration: 1. Mike Charles, Super Quaker, Astro Cobalt 60; 2. Frank Chasteler, Lanzo, Keller 35; 3. Ross Thomas, Lanzo, Astro Cobalt 40.

Stand Off Scale. Six entries, static judging 50%, AMA scale flight maneuvers 50%: 1. Bill Young, Stephens Akro, Astro Cobalt 60; 2. Brian Chan, Bede-5A, Keller 25; 3. Ken Holcomb, Perterfield, Astro SF 15.

(Continued on page 88)

ELECTRICS

(Continued from page 86)

Aerobatics. Four entries, AMA sportsman sequence of ten maneuvers: 1. Steve Neu, MK Arrow, Keller 50; 2. Larry Jolly, XC-40, Keller 25; 3. Ed DePue, Etude, Astro Cobalt 05.

Seven-Cell Pylon Racing. Four entries, hand launch, ten laps short quarter midget course: 1. Larry Jolly, Ohmen, Astro Cobalt 05; 2. Lowell Howe, Fast Eddy, Astro Cobalt 05; 3. Mike Charles, Avanti, Keller .25.

Bob Sliff, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the companies mentioned in this article:*

Astro Flight, Inc., 13311 Beach Ave., Marina Del Ray, CA 90292.

Global Hobby Distributors, 15180 Bandilier Circle, Fountain Valley, CA 92728.

Hobby Horn, 15173 Moran St., P.O. Box 2212, Westminster, CA 92683. ■

GOLDEN AGE OF R/C

(Continued from page 38)

carburetor; a device to control *both* fuel and air intake. When combined with his engines, Johnson's carburetor was highly successful. No exhaust baffle was required.

All this did not happen overnight; we struggled with speed control for many years. For example, the climate differences between the East and West disrupted the carefully-made East coast carburetor settings. Additional nitro in the fuel compensated for the change!

Some of today's carburetors might appear quite complex, but if you examine them closely you'll find that, by one means or another, the fancy mechanics simply provide a way to keep the fuel/air mixture in balance throughout the speed range. It's just a more sophisticated version of the original concept.

Looking back from today's R/C scene with all our ultimate abilities can be confusing. It's hard to believe that there was a time when most everyone was a newcomer, that the best equipment was marginal, and that each flight was a "hope and a prayer" experience. Even though there was little else, retrospect would suggest that it was fortunate that we had rudder-only. There was no experience, no instructors to lean on, and no one to know what the reaction

(Continued on page 95)

GOLDEN AGE OF R/C

(Continued from page 88)

would be to the first control input! Fortunately the planes were, more or less, "guided free flights" that we knew would fly themselves if *we* did not louse up the flight! It isn't hard to comprehend what the chaos would have been if we had elevators and ailerons also!

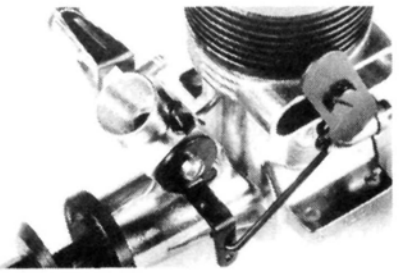
With the need for speed control on early R/C models, engine manufacturers eventually developed carburetors that were able to do the job via a radio signal.

Guiding free flights, however, was no one's idea of what R/C should be. The search for more controls began almost immediately in hope of having *real* R/C. The number 1 priority was engine control to get those free flights down when we wanted them to come down. Next was to get elevators and then ailerons to have "full house" and the ability to have realistic miniature aircraft. However, it turned out to be a long trail to today's exciting R/C abilities.

I've covered the single-channel phase pretty well and all the gimmicks developed to add multi-controls to it. The coming of the reed systems which offered a reliable full house could be the foundation of the flying we see today. However, at the time, reeds were only one of a number of different systems being explored by experimenters. We should take a look at other ideas developed; some have a closer relation to today's equipment than the reed concept does.

Of the successful systems, two basic forms to allow multi-controls evolved. Neither remain today, but both contributed basic knowledge and experience. The most popular was further development of the pulse system of coding the transmitted signal. Then came airborne decoding to separate control channels. The end of each chain was a relay-operated actuator, as it also was with the second type system.

Some manufacturers tried the "tone" path. Basically, if you could transmit one audio tone you could transmit several; one after the other, so to speak. This



K&B Manufacturing offered an exhaust restrictor that operated in conjunction with the barrel position of the carburetor.

R/C concept was like speaking the alphabet, each letter tone representing a different control, thus total separation of control actions. In operation, for example, when a particular control was desired, the appropriate transmitter control position would turn on tone A. Another stick position would turn on tone B, asking for a different control. The receivers were labeled "band pass types," and their filter circuits would decipher which tone was to go to which

(Continued on page 98)

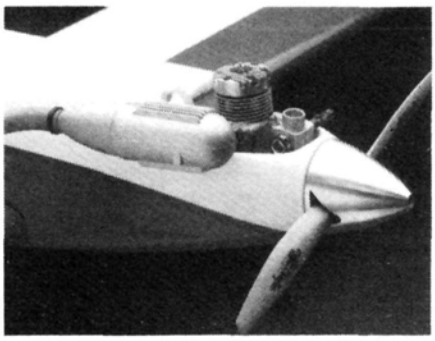
Product News

MRC PIPER CHEROKEE

The Piper Cherokee is a new addition to Model Rectifier Corporation's (2500 Woodbridge Ave., Edison, NJ 08817) line of RTF airplanes. The 48-inch span Cherokee is a low wing trainer that is easy to assemble and has a powerful Enya .19 TV engine factory installed. The fuel tank is preassembled and installed as is the nose gear. The pushrods are in place and ready to be hooked up. Also included are the glowplug, muffler, propeller, spinner, and wheelpants. All you need are some ordinary hobby tools and 5-minute epoxy. You can choose your own control and a four-channel radio will yield fabulous stunts such as snap rolls and stall turns.

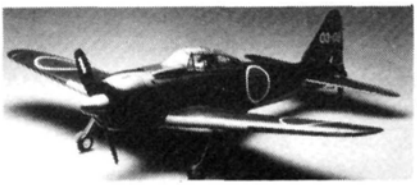
MRC-TAMIYA SUPERSHOT

What every off-road racer dreams about has come true; MRC-Tamiya (2500 Woodbridge Ave., Edison, NJ 08817) has unleashed the Supershot 4WD racer kit. There are 24 ball bearings to smooth your way to victory and a solid driveshaft for power transmission. For power, the tunable RX-540SD Technipower motor was picked to put you on top. The damper springs are adjustable for three different settings and the piston head can be set three different ways giving you a wide variety of chassis set-ups for different road conditions. The 3-step-forward, 2-step-reverse speed control is designed for use with the Tamiya Battery Eliminator (not inlcuded) for good controlability and light weight.



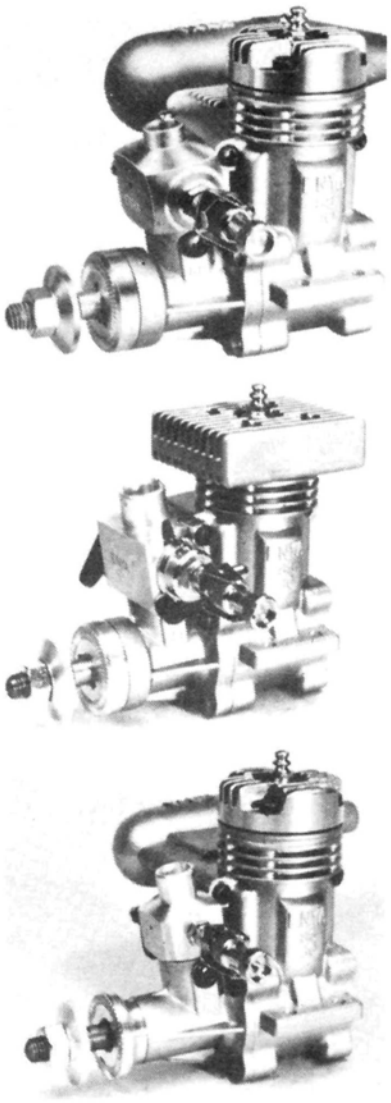
EXHAUST DIVERTER

Craft-Air (6860 Canby Ave., #120, Reseda, CA 91335) announces the release of the Exhaust Diverter, a unique, injection-molded, heat-resistant muffler tip which effectively eliminates at least two-thirds of after-flight clean-up. Because of its design characteristics, the Exhaust Diverter functions extremely well without affecting flight or engine performance. Total weight is a mere 4 grams! The Exhaust Diverter fits muffler tip diameters from 7/16 inch to 9/16 inch (just about any .30-.60 two-cycle engine and many others). It can be installed in seconds and is transferable from engine to engine. Its metal color blends in with the muffler, creating a factory look.



KYOSHO ZERO FIGHTER

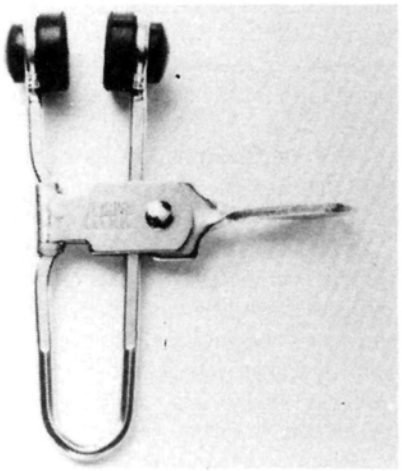
The new Kyosho Zero Fighter combines scale appearance and excellent performance in an easy-to-assemble, electric-powered ARF model that is perfect for the intermediate flier. The 38½-inch span Zero features a molded foam fuselage, wing, stabilizer, and rudder. No building or painting is required. Ailerons are already installed making servo hook-up quick and easy. The kit includes the Kyosho LeMans 240E electric motor and gear reduction unit for plenty of power and clean, quiet flying. Everything is included except a three- or four-channel radio (with mini servos), a 6-cell "flat" battery pack, and a charger. The Zero Fighter is distributed by Great Planes Model Distributors (P.O. Box 4021, Champaign, IL 61820).



ENYA SS SERIES

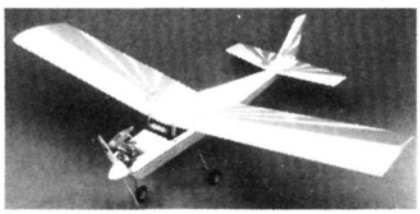
The SS (Super Sport) series of engines from Enya bring Schnuerle-ported power into the hands of all modelers at sport prices. Here's a look at the SS30-size engines for example. The first is the SS30 which has .73 hp for the beginning sport modeler. The Enya SS30BB is for fliers who demand more power and rpm for An rpm range of 2,500 to 16,000 and .83 hp lets you fly to your heart's content. The SS30 HELI is for the helicopter pilot and it comes with a heat sink head to keep things cool while belting out .75 hp. See your favorite hobby dealer or write to Altech Marketing (P.O. Box 286, Fords, NJ 08863) for more info.

Descriptions of new products appearing in these pages were derived from press releases supplied by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News,** or guarantee of performance or safety by **M.A.N.** When writing to the manufacturer about any product described here, be sure to mention you read about it in **Model Airplane News.**



WIN $1,000

One good idea on how to imaginatively use Handi-Klamps, a unique clamping tool, will be worth $1,000. A $500 second prize and five runner-up prizes of $100 each will also be awarded. After receiving a set of Handi-Klamps, an entry form, and contest rules from Zephyr Manufacturing (P.O. Box 759, Inglewood, CA 90307), contestants are asked to consider the most practical new application for the tool. Return the form with a brief description of the application to Zephyr with a postmark no later than October 31, 1986. Although not required, a Polaroid photo of the installation would be helpful.



GREAT PLANES PT-40

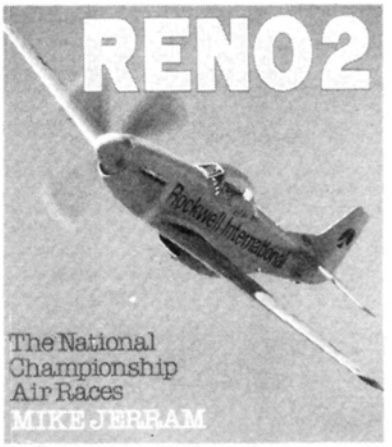
If you prefer a larger R/C airplane that's easier to see in the air, the PT-40, with its big 60-inch wingspan is the perfect trainer for you. The PT-40, available from Great Planes Model Manufacturing (P.O. Box 721, Urbana, IL 61801), is simple, easy to build, and has stable flight characteristics, It's a state-of-the-art trainer that is truly "beginner- friendly." The PT-40 requires a .25-.40 two-stroke or a .30-.45 four-stroke engine and can be built in either a three-or four-channel configuration.

COVERITE COVERING GUIDE

Coverite (420 Babylon Rd., Horsham, PA 19044) has prepared a four-page brochure to help you solve the "which-covering-should-I-use?" dilemma. *The Black Baron's Guide to Covering* includes a chart that lists 58 different aircraft, beginning with pre-WW I and ending with today's ultra modern planes. Beside each airplane is the finish of the original and the recommended covering to use on the model. Five types of covering are detailed and all model categories are included. To get your free copy, send a SASE to Coverite.

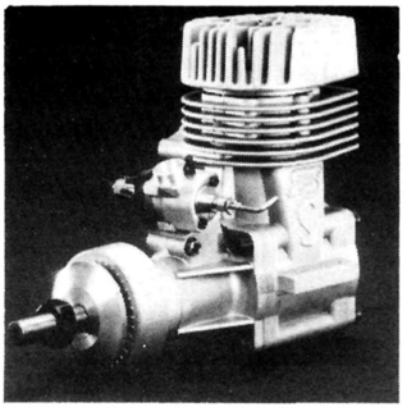
KYOSHO VALENICA

The newest addition to Kyosho's line of electric ARF airplanes is the stylish, easy-flying Valencia. It looks great, flies great, and is easy to build. Sporting an advanced aerodynamic design, this quiet, electric 70-inch wingspan glider includes a generous 8° wing dihedral, an Eppler 178 airfoil with washout, and a unique T-tail configuration that is unaffected by airstream turbulence. A powerful Kyosho LeMans geared motor system featuring the popular LeMans 240E motor is included. Lightweight balsa wood wings are factory assembled, built-up, and MonoKote covered. The super-tough, one-piece fuselage is nearly indestructible, contributing to this glider's stability. All major parts are preassembled and the Valencia can be completed in one evening. The Kyosho Valencia is distributed by Great Planes Model Distributors (P.O. Box 4021, Champaign, IL 61820).



RETURN TO RENO

The National Championship Air Races held in Reno, Nevada, are covered in this exciting new book from Zenith Aviation Books (P.O. Box 1/MN0986, Osceola, WI 54020). This is a follow-up book to the immensely popular *Reno: Air Racing Unlimited.* The Air Races are one of the biggest events for aviation buffs and there can never be too much coverage. *Reno II: National Championship Air Races* is an all-new look at the action, aircraft, and aviators that compete at Reno.



SUPERTIGRE 2000

SuperTigre's S-2000 represents the top-of-the-line in giant-scale engine technology. This mammoth powerplant features Schnuerle-porting, ball-bearing supported crankshafts, and ringed pistons. Since maximum output is generated at intermediate rpm ranges, this engine is fuel efficient and much less noisy that you'd expect. It can pull most giant-scale models weighing up to 25 pounds with wingspans under 8 feet. The SuperTigre S-2000 is distributed by Great Planes Model Distributors (P.O. Box 4021, Champaign, IL 61820).

GOLDEN AGE OF R/C

(Continued from page 95)

relay and control actuator. The circuits separated and routed the coding positively. This was probably the most reliable and maintenance-free method of getting multi-controls that we had in the early days.

Early on, Babcock Models marketed a highly successful and popular tone system. The equipment was sturdily packaged and available for three controls. In effect, the system used three audio tones which the receiver discriminated with tone "filter blocks." One tone was routed to a compound escapement which, in turn, operated an engine escapement. The other two tones operated a multi-channel style servo providing elevator control. This "mixed" arrangement complemented Babcock's products neatly. However, piloting with it was complex. The transmitter had a control stick which moved up and down for normal elevator control. For rudder and engine, you were expected to "beep" the stick from side to side to suit the compound escapement sequence. Even though it was a strange setup, many had reliable flights with it because the basic radio was so solid.

Some of us had some fine flying with the modified Babcock systems. We simply rerouted the tones to three separate single-channel multi-servos, discarding the control stick and using pushbuttons for the three separate controls. Innovation provided a lot of cures in those days!

The shortcoming of Babcock style systems was the weight created by the complex circuitry's need for heavy, costly batteries. In addition, the "tone filter blocks" were hefty. Expanding it to "full house" capability would have only compounded the problem. Reeds followed shortly and proved much more attractive. What a stir Babcock would have created had modern components been available!

One step in that direction was made by Marcy Inkman. His "Marcy Tone" system filled the gap for a short time. This was also a tone system but Marcy resorted to sophisticated sub-miniature and almost modern components to reduce the shortcomings. One of his finer developments had six channels which could have operated three controls using reed style multi-channel servos. Cost was

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GOLDEN AGE OF R/C

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a major problem in those days when you used the "modern components" that we consider so cheap today. What a difference a few years can make!

I got involved in radio development through the widespread desire to have more controls in a usable, cost-effective manner. When I think of all the bench hours that went into such a project I have to take my hat off to *all* the early developers. We wanted to have the control ability so badly that time meant nothing!

I'll hold the description of this tone system and the story of the pulse systems for next time.

Have you ever looked far and wide for something you wanted and needed and then found it hiding in your own workshop. Such is the case with Air Age's *Gas Models*. This was one of their "treasures" before WW II.

Today this book is a must for anyone interested in OT modeling. The book is jammed with 21 famous model designs and it features 21 more useful ideas to make modeling more successful.

How about an antique engine directory, OT airfoil charts, an airfoil plotting method, ignition circuit wiring, how to make gas propellers, and design basics for starters? This gold mine includes many of the initial designs by such well-known modelers as Taibi, Struck, Stahl, Weathers, Murray, Ehling, and Shulman. The first control-line model might even be in there!

Best of all, *Gas Models* is available in limited quantity from *Model Airplane News* for only $6 postage paid. You'll love it.

I hope you're enjoying this column! I want to hear from you and I have a dire need for good black and white glossy photos of early-day planes, equipment, and doings. If you have something interesting it would be most welcome!

Hal "Pappy" deBolt, c/o *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897. ■

PROP EFFICIENCY

(Continued from page 30)

terms of static thrust, rather than horsepower. Indeed, some of the propellers

PROP EFFICIENCY

used on giant scale models appear to have been chosen to do just one thing: generate maximum static thrust.

For example, an 18X4 propeller turning 7,500 rpm will generate 11 or 12 pounds of static thrust, but will reach a rather low peak efficiency of 57% or so at only 25 mph, which is probably not much above the model's stalling speed. A smaller diameter, higher-pitched prop would produce less static thrust but much better all-around performance. The relatively low revving chain saw-derived engines need more pitch than glow engines; 8 to 10 inches for a typical scale model and considerably more for a relatively high powered, clean model. Using too low a pitch is like driving your car in second gear all the time; it's good for initial acceleration and steep hills but not much else.

For a given horsepower and blade angle, static thrust is proportional to the square root of operating rpm. A large propeller on a chain saw engine turning at about half the rate of a glow engine, or a 2:1 reduction drive with the glow engine, can produce about 40% more static thrust for the same power. As airspeed increases, the advantage decreases rapidly. If propeller pitch is increased to compensate for the lower rpm, the static thrust advantage can disappear entirely, but overall efficiency will be higher.

With reduction gearing there's no theoretical limit to the static thrust that can be produced by a given horsepower. A .60 engine, geared down to 100:1 could produce about 100 pounds of static thrust with the appropriate gigantic propeller, but if you want to go more than 10 mph, forget it.

The ideal propeller would have one blade with a counterbalance weight hidden in the spinner. The rotating off-center thrust force, however, couldn't be counterbalanced, resulting in noticeable vibration. Two-bladed props are a more practical compromise and are easier to manufacture.

Propellers with more than two blades have a smaller diameter and thus a low tip speed. They might be more efficient if the larger diameter two-balder had excessive tip speed, although this isn't often an important consideration with models. If tip speed of the two-bladed prop isn't more than 650 to 700 feet per second, a three-bladed prop will be about 3% less efficient than the corresponding two-bladed unit. The diameter should be about 7% less than the two-bladed prop. Three blades tend to be quieter because of the lower tip speed and also because noise doesn't tend to peak once and twice per revolution and thus reinforce engine noise.

Four-bladed propellers are easier to construct in wood than three-bladers, but are about 5% less efficient than two-bladers. The efficiency losses can be reduced by using narrower blades, indeed some studies have shown that a four-bladed propeller with 50% narrower blades can be as efficient as the corresponding two-bladed unit. A blade this narrow might not be practical in wood due to excess flexing but some narrowing of the blades, say 25% or 30%, should be allright and would push efficiency pretty close to that of the two-bladed prop. This requires increasing the diameter by about 5% to compensate for the blade area removed. I urge extreme caution when using four-bladed props made by notching and fitting together two wood props. The material left at the hub might be insufficient to resist centrifugal loading, considering the stress raiser produced by the notch. With the blades narrowed and thinned, especially from mid span of the blade to the tip, they might (!) be strong enough to run at 900 feet per second tip speed, but I would be happier at 750, unless some kind of reinforcing were applied to the hub area. I've had good two-bladed wood props get tired after 20 or more hours of operation at around 900 feet per second tip speed, and the four-bladed props would be considerably higher stressed.

PROP EFFICIENCY

Electric motors can be made to operate efficiently over a wider rpm range, giving the modeler more freedom in optimizing the propeller to the model. Shaft speeds and horsepower are generally lower than would be found with most internal combustion engines. Lower rpm tend to require a higher pitch-to-diameter ratio which is good for efficiency; particularly important for the electric model which doesn't usually have any great surplus of power available. Narrower blades can be used without danger of flutter at the lower tip speeds of electrics for a further, very worthwhile gain in efficiency. Pitch-to-diameter ratios of more than 1.0 can be used to good effect where the motor speed is relatively low and the model's weight and drag would indicate an underpitched condition otherwise. Commercial propellers with pitch-to-diameter ratios over 0.8, except in very small sizes used for control-line speed and R/C pylon racing, are extremely hard to find, so you might have to twist the blades of stock propellers to a higher pitch, unless you're into making propellers from scratch.

The curves for efficiency versus advance ratio, pitch-to-diameter ratio, and blade width can be combined to find the efficiency of almost any propeller at any airspeed and rpm. For example, find the efficiency of a 20x8 prop at 8,000 rpm at 50 mph airpseed: this prop has a pitch-to-diameter ratio of 8/20 = 0.4. The curve for efficiency versus pitch; diameter-to-ratio indicates a peak efficiency of about 59%. A quick calculation shows that 8,000 rpm and 50 mph gives an advance of 6.6 inches per revolution, equal to 0.82 times pitch. The curve of efficiency versus advance ratio was plotted for a prop with a pitch-to-diameter ratio of 0.7, but the overall shape of the curve is reasonably accurate for most any propeller. The curve shows a peak efficiency of about 76%, and about 74% at an advance equal to 0.82 times pitch. 74/76 times the peak efficiency of 59% for the 20x8 indicates 57.4% efficiency. The propeller is operating at nearly peak efficiency, although slightly less pitch and more diameter would help a little. ■

BRAVO SIDEBAR

(Continued from page 25)

cockpit. After flying this primary configuration for 14 hours, Morrisey decided

that things were a bit too breezy. An enclosed cockpit and wheelpants were added, producing the advanced version of the single-place Bravo. This airplane was unofficially dubbed the "Fighter" because it looked like several WW II fighters. The Bravo was converted to a two-place aircraft by moving the windshield and instrument panel forward and adding a front seat and second set of controls. Morrisey applied the original white and silver paint to the Bravo so the lines of the airplane would stand out.

During the time between the Model 2150 and the Bravo project, Bill was involved in many different occupations: helping to establish an airline to deliver Carnations from Colombia, South America to Miami, Florida; consulting; a two-year stint at Continental Motors; and managing the Oceanside Municiple Airport in California. A close friend and neighbor of Bill's in Oceanside was the late Ed Schmued, designer of the P-51 Mustang.

Construction of the Bravo began in January 1981 and it was flown by Bill on June 30, in Oceanside. Development time of the Bravo was short because it drew heavily on the earlier Morrisey designs. The basic fuselage structure is the same as the Nifty and the wings are the same as the Model 2150 (minus a heavy center section which served primarily to carry the main landing gear on the tri-geared 2150). Interestingly, the Bravo was originally named "Trigger" which is reflected in the Bravo's serial number, TRGR-1.

The Bravo fuselage and fin is welded 4130 steel tubing covered with fabric aft of the cockpit. Removable aluminum side panels allow easy access for maintenance. Aluminum stringers form the turtledeck, which also provides a baggage area. The wing, stabilizer, elevator, and rudder are all aluminum. The steel

BRAVO SIDEBAR

landing gear is off a Cessna 150. The canopy frame is fiberglass and is hinged just above the right side window. A 150 hp Lycoming 0-320 turning a 74-inch, fixed-pitch aluminum propeller pulls the Bravo through the air.

Flying the Bravo is actually quite simple, even for low-time pilots. The pilot's seat is in front and provides good visibility during all flight regimes. Ground handling is easy because of the wide-spaced main gear which is located well forward. Takeoffs occur quickly and are followed by a healthy climb rate of about 1,450 feet per minute. Cruise speed is above 120 mph. Seven degrees of dihedral in each wing panel provides plenty of stability. Although it wasn't designed for aerobatics, the Bravo will perform simple looping and rolling maneuvers with ease. Spins are extremely difficult to enter. Landing approaches are rock solid and even a poor flare rarely causes any bouncing when you touch down, thanks to the "soft" landing gear.

Hazel Sig and Maxey Hester bought the prototype (and only existing) Bravo

from Bill in September 1985. Hazel flew it from Bill's hangar at the Las Vegas Air Terminal to Montezuma, Iowa, while Maxey flew along side in their Beechcraft Bonanza. Once home in Iowa, the Bravo was given a bright new red and white paint job along with several other minor changes. The original registration number, N124BM, was changed to N37HM when the new paint was applied. Hazel and Maxey are proud to be the owners of another exciting and unique aircraft, and plan to spend many enjoyable hours of flying and showing their beautiful Morrisey Bravo. ■

TURN-A-CAT

(Continued from page 16)

covered foam core. A double tapered wing is fairly difficult to build but it's light and can be made lighter by putting a lot of holes in each rib. I like to mark the centerline on each rib and draw a centerline on the leading and trailing edge stock with a razor saw. Cut the slots in the leading edge and block up the leading and trailing edge over the plans so that the centerlines are all the same height (1½ inches) off the building board. You can add wash-out here by raising the trailing edge tip but mark your wing right or left so you don't end up with wash-in instead of wash-out. Place the ribs on the bottom spar and in slots being careful to align the centerline marks. Now add the top spar, check alignment everywhere, and glue everything with cyanoacrylate glue. Now use a long straightedge to get the ribs to line up and add sheeting. Join the wings while they're upside down and flat on a table so you can leave off the center section sheeting until after they're joined. Since no dihedral brace is used, the wing joint must be fiberglassed. This might sound like a complicated procedure but the hardest part is cutting out the ribs. Thanks to the miracle of cyanoacrylate glue, each panel can be set up and sheeted in less than an hour.

The foam core with sheeting and cap strips is a fast and very light way to go especially if the foam is cut out between the cap strips. This wing was used on the prototype and seems to have ample strength for outside loops and sharp pull-ups. Cut the foam cores with 1 1/16-inch wash-out in the tips and keep weights on the foam blocks until the cores are sheeted. I used Pacer's* Zap foam prep and Zap-A-Gap on the leading and trailing edge stock and cap strips and contact cement on the sheeting. Measure the cap strip locations from the tip inward so they will align when the foam is cut out. Leave the top center section until last. Use ¼-inch square hardwood to make servo mounts, then line up the cutout with 1 1/16-inch sheet balsa. Recess the servo so that the arm clears the covering.

The stab can be made any way you want. I like the method shown because it's easy to build, very light, and seems to make the plane more responsive. Lay the ¼x½-inch balsa spar on the plan. Notch the leading and trailing edge as shown. Lay them on the plan and raise them up on ⅛-inch scrap balsa. Cut and glue the center and tip pieces. Use ⅛x½-inch balsa strips to serve as ribs but don't try to form them until they are glued in place. Remove them from the plans and use sandpaper on a straightedge to form

(Continued on page 116)

TURN-A-CAT

(Continued from page 107)

the airfoil that you want. Straight compound paper works great for me.

The fuselage is built on the ⅜x4x48-inch sheet balsa. Strike a centerline and reference everything off this line. Mount your engine, with the spinner back plate on the front bulkhead and adjust the location of the nose ring to suit your engine. Use a straightedge with coarse paper to get the final shape of the balsa blocks. The razorback and canopy starts as a 1/16-inch balsa profile with ¼x⅜-inch balsa strips attached and trimmed to the ⅜-inch sheet. Cut the ⅛-inch sheet turtledeck sides to fit on top of the ⅜-inch sheet and against the sides of the ¼x⅜-inch sticks that form the profile. Slit the ⅛-inch sheet at the base of the canopy outline and roll the bottom part over the former F4. Fill the front of the canopy with scrap balsa and round off to suit your liking.

Check the cheek cowl clearance around your engine. At least ⅛-inch clearance should be left for cooling. Cut away the bottom rear portion of removable cowl to allow for proper engine cooling.

Make sure the plane balances about ¼-inch in front of the spar line. It flies great with the CG on the spar line but the nose will come up on low throttle which makes it hard to land. Takeoffs require a slight amount of left rudder and a little bit of up elevator to keep the tail wheel down.

The long tail moment helps to eliminate ground loops. Once in the air you'll quickly notice how precisely every control performs. Trim to neutral flight and wring it out. Give it a lot of room on your landing approach because the light wing loading wants to keep it in the air.

I assure you that every flight with Turn-A-Cat will be a satisfying experience.

**The following is the address of the company mentioned in this article:*

Pacer Technology & Resources, 1600 Dell Ave., Campbell, CA 95008. ■

CONTROL SYSTEMS

(Continued from page 13)

in the world will be deficient.

Many modelers have found that a closed-loop cable control system is a good way to eliminate slop. It's also very positive since the guiding force is always

(Continued on page 119)

CONTROL SYSTEMS

(Continued from page 116)

pulling vs. pushing as with solid pushrods. One thing to remember about cables is that if you lose one side you're in trouble.

Generally, cables are limited to throttle and nosewheel steering control, but in this case the cable is much larger than that used in a closed-loop system and it operates a lot like a pushrod. The only real difference is the load it must endure, which is much less than that found on a control surface while in flight.

A captured cable, one that runs inside a long length of plastic tubing, is used a lot on sailplanes. Nyrods, another popular method of control hook-up, consist of two plastic rods; the smaller one runs inside the larger one. The thing to remember with the flexible Nyrod or Gold-N-Rod control systems is that they must be secured at each end on the outer sheath. If not, you'll have no control. Nyrods and Gold-N-Rods can be used for throttle, nosewheel steering, and control surfaces on sailplanes and lighter powered models.

The accessories available for the control system on your model can boggle your mind! It seems that everyone has a slightly different technique, and manufacturers of accessories make everything imaginable for this important part of your model. Different types of servo output arms are usually provided with your radio system to give you the adaptability necessary to suit just about any requirement. Since all servos operate in a circular motion (some used to be linear), exercise care when selecting the proper output for the assigned task, as well as the linkage you use to go from the servo to the control surface.

Attaching the linkage to the servo arm can be done in several ways. Here again, many different accessories are available and can be used, depending on the application. Some of the most useful items you'll ever find are Du-Bro's E-Z Connectors. An E-Z Connector is a brass fitting that has a pin which fits into one of the holes in your servo output. It's secured underneath by either a plastic slip-on retainer or a metal washer. The top part of the fitting is threaded and a hole is drilled along the horizontal centerline to receive the control wire or cable. Once the position is established, a locking screw on the top of the fitting can be tightened with a screwdriver and you're set. If you want to change the position of the control wire, simply loosen the screw and make the adjust-

CONTROL SYSTEMS

ment. This accessory is especially useful in setting up your throttle linkage. CG Models makes a similar item called the Pushrod Connector.

Another way to come off the servo is with a simple Z bend in the wire, which is probably one of the oldest methods used. An L bend with a small wheel collar as a retainer works well also. A standard clevis also works but you can't use them on a rotary output since the arc of the wheel will usually not allow enough clearance. If a clevis is used, a straight output arm should also be used and even then you can have a clearance problem. Check this by moving your controls with the transmitter. If the control connection moves back and forth as it should, you're okay. If it moves sideways when the control is in a maximum throw situation, you should change it.

Servo installation should be done according to the directions given with your radio. Make sure they are secure in the airplane but not rigid. You need the shock-absorbing quality of the grommet to protect the components in the servos from engine vibration.

Mount the servos in their trays, if provided, and mount the trays to hardwood rails. The less movement the servo has, the more positive your control response will be. Allow sufficient clearance between the servos so the control output arms don't interfere with each other. The servo arms should be situated so that the output point of attachment of the pushrod is exactly 90° from the horizontal centerline of the airplane after all trim adjustments have been made.

Every control attachment point on a model should have freedom of movement without slop, and each clevis should have a retainer to prevent it from opening unintentionally. A small piece of fuel tubing works fine.

Hinges for your model come in all shapes, types, and sizes. Here again the choice will depend on the model. Some hinges have pins that support the pivot point while others are solid polypropelene or nylon. Whichever one you choose, just make sure that it works freely and is secured in the mating surfaces. On flat, nylon-style hinges it's good not only to glue them in place but to drill a hole halfway back on each side and secure them with a toothpick glued into the wood. Cut the toothpick off flush with the surface and sand it down. The toothpick is really an insurance policy that you'll never regret. I've never seen a model lose a control surface that was done this way.

A new hydraulic control system is in the works that has a pressurized reservoir of hydraulic fluid which is transmitted on command to a cylinder that activates the control surface.

The best method of control is the one that works all the time, the same way, and every time. ■

Club of the Month

AVIATOR NEWS

The Davison Aviators Club of Davison, Michigan, is the *Model Airplane News* Club of the Month for September 1986.

The Davison Aviators are not just a group of modelers who happen to get together at the flying field on Sunday; they have a spirit of togetherness that extends beyond that. Of course their most immediate attention is given to the group. Don Parks, who edits their club newsletter, the Davison Aviator News, does a great job in this regard. Parks, a fine modeler in his own right, recently won second place in Military Stand-Off Scale at Toledo, although club president, Lonnie Milhorn maintains that Don has a phantom builder—his wife.

Flying at the club's field is a challenge for some members. A lake that is located ¼ mile away likes to slurp up models, as Paul Hibbard recently discovered. Another member, Roy Lock, found that trees also have an attraction for model airplanes—especially his! His last flight ended 150 feet short of the runway and 20 feet up. Well, he can fly with confidence now because the tree is gone.

Another member, Bernie Linton, has a new modeler in his family—his cat. Bernie was teaching it how to MonoKote and everything was going great until the flying feline decided to eat the airplane for dinner. Now the cat is hooked on MonoKote-covered airplanes for meals.

Model Airplane News is pleased to award two free one-year subscriptions to the Davison Aviators for their outstanding efforts, which are to be given by them to their deserving junior members

Congratulations!

Each month M.A.N. will select the club newsletter that best shows the club's activities and energies directed toward the furtherance of the hobby. The award is not based on size or quality of the newsletter, and can be about any aspect of the hobby (F/F, C/L, R/C, boating, cars, etc.). M.A.N. will award two free one-year subscriptions to be given by the club to outstanding junior members. So send your newsletters to Model Airplane News, Club of the Month Contest, 632 Danbury Rd., Wilton, CT 06897.

Classified

RAZOR BLADES: single-edge industrial quality, super sharp. 100/$4.25, 200/$8.50, 300/$12.50, 500/$20.50, 1,000/$40.50; add 10% postage west of the Mississippi. Cobbie's Gifts, Box 2, Deal, NJ 07723; 201-922-9898.

1930-1950 model magazines for sale. Low price, $1.00 for list. Bruce Thompson, 328 St. Germain Ave., Toronto, Ontario, Canada M5M 1W3.

SIX NEW 1" = 1' CONSTRUCTION BLUEPRINTS for "flying-scale" aircraft. Large S.A.S.E. for details. S.A. Lambert Jr., Apt. 308, 2200 W. Cornwallis Dr., Greensboro, NC 27408; 919-288-2944.

WANTED: RTF U-Control planes from Cox, Wen-Mac, Comet, Aurora, Testors, etc., complete or pieces, buy or trade. John Fietze, P.O. Box 593, Lynbrook, NY 11563.

AVAILABLE: New Kraft Channel Master system $125. Also Kraft Dual Conversion FM narrow-band receivers and matching transmitter modules for $90. Wanted: Any year Kraft 7C or 7CS transmitters. Jay-En Sales, 757 NO'U St., Hilo, HI 96720; 808-959-6590 (after 5 p.m. Mon. through Fri., all day Sat. & Sun.).

ANTIQUE MODEL IGNITION ENGINES—PARTS CATALOG, 50 pages, precision cast timers, original cylinder heads, point sets, drive washers, tanks, for GHQ, O&R, O.K., many others. Large catalog $4.00 pp. Chris Rossbach, RD 1, Queensboro Manor, Gloversville, NY 12078.

HARDWARE AND SOCKET HEAD cap screws, all sizes, low prices. Write for complete list. Example 6-32x1" only $4.25 per hundred. Lane Distributing, P.O. Box 42A, Netcong, NJ 07857.

WANT TO BUY: Spark plugs ¼x32 original production Champion V-2, V-3, or equivalent A-C, Autolite, etc. Any quantity. Woody Bartelt, 1301 W. Lafayette, Sturgis, MI 49091.

SCALE DOCUMENTATION: PLAN ENLARGING, photo packs, 3-views, drawings for 1,600 aircraft. Super-scale R/C plans for giant, sport, 30-page catalog $3.00. SASE for information. SPPS, 3209 adison, Greensboro, NC 27403-1424; 919-292-5239.

TORQUE STANDS: Measure engine horsepower .049 to .60 or .15 to 1.2. Precision machined from bar stock, adjustable engine mount $250 or $325. For Kavan Twin, O.S. FT-240 and similar radial mount engines measure up to 5 horsepower at 8,000 rpm $625. Postpaid U.S.A. Armstrong Research & Technology, 2123 4th Ave. North, Irondale, AL 35210.

FOR SALE: 2,000 model airplane magazines. New condition. 1945 through 1985. Send $1 and SASE for list. J. Willard Vaughn, 506 Wadsworth St., Radford, VA 24141.

R/C MODEL SIMULATOR: First affordable Flight Simulator with Ground School for novice. Commodore 64, disk, joystick: no expensive control box. Send $5.00, diskette, and SASE ($8.00 and 1 supply) to: J. Lane, 20163 Woodbend, Northville, MI 48167.

USED, NEW ENGINES: Older, modern, ignition. Cox parts. Sell, trade, buy. SASE for list. Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; 619-375-5537.

WANTED: The following types of older radio control equipment. Kraft Systems any year, must be American made, Orbit reed and propo sets any year, Micro Avionics any year, E.K. Logitrol any year, RS systems any year, Bonner systems any year, F&M reed sets, C&S reed sets, Bramco reed sets, Citizen Ship reed sets and pulse systems, Control Air pulse systems. Also interested in Duramite and Transmite reed servos, anco reed servos, Dmeco servos, Medco packs, Rand actuator systems both Lo/Hi rate ghost, Min X reed and pulse systems. Send us a list with color picture of equipment that you wish to sell or call for approximate quote over the phone. Send self-addressed envelope for list of equipment and systems that we have gone through and is ready for sale now. We pay the highest prices for complete reed and pulse systems, and can offer trades in some cases on new Airtronics and Futaba equipment. Jay-En R/C Sales, 757 NO'U St., Hilo, HI 96720; 808-959-6590 (after 5 p.m. Mon. through Fri., all day Sat. & Sun.).

PRIVATE COLLECTION: Hundreds of aviation magazines for sale—*Popular Aviation, Flying, Model Airplane News, Air Trails, RAF Flying Review, Wings,* and many others. 1932-1960. All in excellent condition. Send $2 for list. William C. Fort Jr., 4161 Robin Hood Rd., Jacksonville, FL 32210.

NEWEST TWO-CYCLE TECHNOLOGY: Two new 61 Schnuerles that have all other 60 class engines for breakfast. The two new Fitzpatrick 61s—FSR-ABC. See full-page color ad in this very *M.A.N.* issue. Fitzpatrick Engines USA.

APPLE AVIATION PUBLIC DOMAIN SOFTWARE AIRCRAFT DATA BASE AND SLIDE SHOW. Two disks $24.95. Free catalog with purchase or send $1 for catalog to H.M. Technology, Dept. 1207, 1204 Ave. V, Brooklyn, NY 11229.

WANTED: Model airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063.

DESIGNER WANTED: R/C or slot racer with mechanical ability to work in research and development. Travel weekends. Reply: Parma International, Inc., 13927 Progress Parkway, N. Royalton, OH 44133 or phone: 216-237-8650.

R/C SCALE PLANS, Stinson SR9, Stearman PT17, 1/6-scale $22.50, ¼-scale $35.50, catalog $1. Richard Barron, 11506 Ohio Ave., Youngtown, AZ 85363.

SCALE DRAWINGS of flying wings and other unique aircraft. Send $2 for catalog to: Bill Young, 8106 Teesdale Ave., N. Hollywood, CA 91605.

BEGINNERS, discouraged by too-fast "trainers"? Send $1 for treatise scale-rating over 20 well-known radio-control models for their ease-of-flying. Jim Waterman, 3818 Deerfield Dr., San Antonio, TX 78218.

WANTED: Buy or trade Cox Thimble Drome, Macoy or O&R metal race cars—complete. C. Denison, 110 Harrison Hill Rd., Swannanoa, NC 28778, 704-686-5713.

AIR AGE GAS MODELS: The best of the Golden Oldies from the early days of *Model Airplane News.* Construction articles and plans for contest winners of the '30s and '40s plus technical articles of that era. If you're a real old timer, or a "new" old timer, you'll love this book! Send $4.95 plus $1 for postage and handling ($2 foreign) to *M.A.N.,* 632 Danbury Rd., Wilton, CT 06897.

Send ad and payment to: Classifieds, *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897.

Non-commercial classified ads (commercial ads of any kind not accepted at this special rate). Rate: 15 words or less, $4.50 payable in advance. No charge for name and address. Additional words, 25¢ each.

Commercial classified ads (rate applies to anyone selling on a commercial basis—retailers, manufacturers, etc.). Rate: 50¢ per word, payable in advance. Count all initials, numbers, name, address, city and state, zip and phone number.

Closing date for either type of ad is the 15th of the third preceding month (for example, January 15th for the April issue). We do not furnish box numbers. If you would like your ad to run in more than one issue, multiply amount of payment by number of months that ad is to run.

It is not our policy to send sample copies or tear sheets.

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